

APPENDIX C

Existing Data Compilation

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Acronyms

AEC	U.S. Atomic Energy Commission
AL	action level
ALF	Action Levels and Standards Framework for Surface Water, Groundwater, and Soils
Am	americium
AST	aboveground storage tank
bgs	below ground surface
BNA	base neutral acid
BZ	Buffer Zone
CDPHE	Colorado Department of Public Health and Environment
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm ²	square centimeter
COC	contaminant of concern
CPIR	Contingency Plan Implementation Report
cpm	counts per minute
cpm/ft ²	counts per minute per square foot
CSU	Colorado State University
CSV	Central Storage Vault
CWTS	Caustic Waste Treatment System
D&D	Decontamination and Decommissioning
DCHP	dicesium hexachloroplutonate
DCE	dichloroethene
DOE	U.S. Department of Energy
dpm	disintegrations per minute
dpm/cm ²	disintegrations per minute per square centimeter
dpm/g	disintegrations per minute per gram
dpm/kg	disintegrations per minute per kilogram
dpm/L	disintegrations per minute per liter
dpm/m ²	disintegrations per minute per square meter
dpm/m ³	disintegrations per minute per cubic meter
dpm/100 cm ²	disintegrations per minute per 100 square centimeters
EP	Extraction Procedure
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FIDLER	Field Instrument for the Detection of Low-Energy Radiation
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
ft	foot
ft ²	square foot
ft ³	cubic foot
GC/MS	gas chromatography/mass spectrometry
g/L	grams per liter
gpm	gallons per minute
GPR	ground-penetrating radar
HAER	Historic American Engineering Record

Acronyms

HASP	Health and Safety Plan
HCL	hydrochloric acid
HEPA	high-efficiency particulate air
HNO ₃	nitric acid
HPGe	high-purity germanium
HRR	Historical Release Report
HVAC	heating, ventilation, and air conditioning
I/O	input/output
IA	Industrial Area
IAG	Interagency Agreement
IABZSAP	Industrial Area and Buffer Zone Sampling and Analysis Plan
IHSS	Individual Hazardous Substance Site
IIR	Internal Investigation Report
ITPH	Interceptor Trench Pump House
ITS	Interceptor Trench System
kg	kilogram
K-H	Kaiser-Hill Company, L.L.C.
km/m/kg	kilometers per meter per kilogram
KOH	potassium hydroxide
LLW	low-level waste
LSA	low specific activity
μCi	microcurie
μg/g	micrograms per gram
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
μg/m ²	micrograms per square meter
μg/m ³	micrograms per cubic meter
μgm/m ³	microgram meters per cubic meter
m ²	square meter
mCi	millicurie
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MPL	maximum permissible limit
mr/hr	millirems per hour
N	normal concentration
NaI	sodium iodide
NaOH	sodium hydroxide
NCR	no carbon required
NFA	no further action
NPDES	National Pollutant Discharge Elimination System
NPWL	New Process Waste Lines
OPWL	Original Process Waste Lines
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PA	Protected Area

Acronyms

PAC	Potential Area of Concern
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
pCi/g	picocuries per gram
pCi/L	picocuries per liter
pCi/m ³	picocuries per cubic meter
PCOC	potential contaminant of concern
PMJM	Preble's meadow jumping mouse
ppm	parts per million
PPRG	programmatic preliminary remediation goal
PSZ	Perimeter Security Zone
Pu	plutonium
PU&D	Property Utilization and Disposition
PuF ₄	plutonium tetrafluoride
PuSPS	?
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
Ra	radium
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RFCA	Rocky Flats Cleanup Agreement
RFP	Rocky Flats Plant
RFETS or Site	Rocky Flats Environmental Technology Site
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RLCR	Reconnaissance-Level Characterization Report
RMRS	Rocky Mountain Remediation Services, LLC
RSAL	radiological soil action level
SAL	soil action level
SSAL	subsurface action level
S&W	Swinerton and Walberg
SAP	Sampling and Analysis Plan
SEP	Solar Evaporation Ponds
SID	south interceptor ditch
SNM	special nuclear material
S-R	Stacker-Receiver
SS&C	sand, slag, and crucible
SVOC	semivolatile organic compound
SWDA	??
TAL	Target Analyte List
TCA	trichloroethane
TCE	trichloroethene
TCFM	trichlorofluoromethane
TCLP	Toxicity Characteristic Leaching Procedure
TDEM	time-domain electromagnetic
TDU	thermal desorption unit

Acronyms

Th	thorium
TRU	transuranic
U	uranium
UBC	Under Building Contamination
UST	underground storage tank
VOC	volatile organic compound
WRW	Wildlife Refuge Worker
WSRIC	Waste Stream and Residue Identification and Characterization
WSI	Wackenhut Security, Inc.
yd ³	cubic yards

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INTRODUCTION

This existing data compilation for the Rocky Flats Environmental Technology Site (RFETS or Site) Industrial Area (IA) and Buffer Zone (BZ) Sampling and Analysis Plan (SAP) (IABZSAP) has been derived from a number of sources. The Historical Release Report (HRR) (DOE 1992a), first released in 1992 and updated yearly, contains information on all Individual Hazardous Substance Sites (IHSSs), Potential Areas of Concern (PACs), and Under Building Contamination (UBC) Sites. Information on many of the IHSSs and all of the PACs has been gathered from the HRR (DOE 1992a). In the 1990s, Resource Conservation and Recovery Act (RCRA) Facility Investigations/Remedial Investigations (RFI/RI) were initiated at Operable Units (OUs) 1, 2, 4, 5, 6, 7, 8, 9, 10, 12, 13, and 14. RFI/RI at OUs 1, 2, 4, 5, 6, and 7 were completed and information from those reports are included, as appropriate, in this data compilation. The types of results from the OUs 8, 9, 10, 11, 12, and 13 RFI/RI vary and have never been published. Information from these RFI/RI may include detailed historical information, validated analytical data, unvalidated analytical data, and high-purity germanium (HPGe) survey data. Data have been included when available. Associated with these OU studies are the RFI/RI work plans, which are used as appropriate. The complete set of surface and subsurface soil data for the IA are presented in the IA Data Summary Report (DOE 2000a) and for the BZ in the Draft BZ Data Summary Report (DOE 2001a).

Descriptions of UBC Sites were gathered from current Decontamination and Decommissioning (D&D) plans, Waste Stream and Residue Identification and Characterization (WSRIC) documents, the Historic American Engineering Record (HAER) for RFETS, and other Site documents.

This data compilation is organized by IHSS Group. Maps of the IHSS Groups, IHSSs, PACs, and UBC Sites are included as Figures 1 and 2 of the IABZSAP.

GROUP 000-1

Solar Evaporation Ponds IHSS 000-101

The Solar Evaporation Ponds (SEP) (IHSS 101) are located on the northeastern side of the Protected Area (PA) and consist of five surface impoundments: Ponds 207-A, 207-B North, 207-B Center, 207-B South, and 207-C. The major features in IHSS 101 are the SEP, Original Pond, Effluent Line IHSS 700-149.1 Interceptor Trench System (ITS), and areas in the immediate vicinity including IHSS 176 (Swinerton and Walberg [S&W] Contractor Storage Yard) (DOE 1995a).

The SEP were used to store and evaporate low-level radioactive process wastes and neutralized acidic wastes containing high levels of nitrate and aluminum hydroxide. The SEP also received additional wastes, including treated sanitary effluent, aluminum scrap, alcohol wash solutions, drums of radiography solutions, leachate from the RFETS sanitary landfill, ITS groundwater, saltwater, personnel decontamination wash water, hydrochloric acid (HCl), nitric acid (HNO₃), hexavalent chromium, and cyanide wastes. The original pond was constructed in 1953 and used until 1956. Pond 207-A was placed in service in

1956. Ponds 207-B North, Center, and South were placed in service in 1960, and Pond 207-C was constructed in 1970 (DOE 1995a).

In the 1980s, SEP use was phased out and transfer of process wastewater into the ponds ceased in 1986. Cleanup activities began in 1985 to drain and treat the liquid waste and process the pond sludges (DOE 1995a). All SEP were drained and the sludge was removed in 1995.

Contamination in surface soil was investigated by conducting a gamma survey and collecting 72 soil samples in the SEP area and 38 soil samples in IHSS 176. The metal and radionuclide concentrations that exceeded background levels are located in the immediate vicinity of the ponds, primarily on the berms between ponds. In the SEP area, the maximum concentration of beryllium was 9.6 milligrams per kilogram (mg/kg), a concentration well below the above-Rocky Flats Cleanup Agreement (RFCA) wildlife refuge worker (WRW) Tier-II action level (AL) (921 mg/kg). Cadmium was detected at 382 mg/kg, which is also below the WRW AL level (962 mg/kg). The highest activities of americium-241 were present on the berms of Pond 207-A, with a maximum value of 220 picocuries per gram (pCi/g), above the WRW AL (76 pCi/g). Americium-241 was present in other surface soil ranging from 0.5 to 27 pCi/g, with the majority of activities below 10 pCi/g, and all activities less than the WRW AL.

The distribution of plutonium-239/240 in surface soil was similar to americium-241. However, all activities were, at some locations, greater than the WRW AL (pCi/g), below the Tier-II AL and ranged from 56 pCi/g on the southwestern berm of Pond 207-A to below 20 pCi/g elsewhere in the area. Uranium (U)-233/234 activities were below the Tier-II WRW AL (300 pCi/g) and ranged from 1.24 to 41 pCi/g. Only 2 of 39 sample activities exceeded 8 pCi/g. uranium-235 activities were below the Tier-II WRW AL (8 pCi/g) and ranged from 0.09 to 2.3 pCi/g. uranium-238 activities were below the Tier-II WRW AL (351 pCi/g) and ranged from 1.27 to 27 pCi/g.

Subsurface contaminants in the SEP area that exceeded background activities include nitrate, zinc, americium-241, plutonium-239/240, radium-226, tritium, uranium-233/234, uranium-235, and uranium-238. None of these containments were at concentrations exceeding the WRW ALs. Of these, only Am-241 activities were above the Tier II AL, with the activity of one sample at 44.68 pCi/g.

Six interceptor trenches and associated sumps were installed on the SEP hillside in 1971. Some of the trenches and sumps were destroyed during construction of the Perimeter Security Zone (PSZ) and the rest were abandoned in place. The ITS was installed in 1981 and consists of gravel-filled trenches approximately 1 foot (ft) wide, ranging in depth from approximately 1 to 27 ft below ground surface (bgs). Water collected in the ITS flowed by gravity to the Interceptor Trench Pump House (ITPH) located near North Walnut Creek. Until 1993, the collected water was pumped from the ITPH to Pond 207-B North. In 1993, three 750,000-gallon modular storage tanks were installed on the northern side of North Walnut Creek. At that time, the ITS water was temporarily stored in the modular storage tanks and then pumped to Building 374 for evaporation (DOE 1995a).

In 1999, the SEP plume groundwater collection and treatment system was installed to intercept the nitrate- and uranium-contaminated groundwater derived from the SEP area. The new system collects water from the preexisting ITS and additional groundwater believed to underflow the ITS, and diverts the water to a treatment cell. The groundwater collection system extends approximately 1,100 ft in an east-west direction along the North Perimeter Road. Construction was restricted to the disturbed area around the North Perimeter Road to reduce impacts to Preble's meadow jumping mouse (PMJM) habitat.

Effluent Lines, IHSSs 700-149.1 and 700-149.2

In 1972, two 1.5-inch polyvinyl chloride (PVC) pipes were installed to transfer wastes between Building 774 and the 207 SEP. These lines were abandoned in place in 1980 after the vapor compression evaporator in Building 374 was constructed.

While still in use, sometime during June or July 1973, a contractor broke the plastic line that ran from the evaporation ponds to Building 774. Repairs were made and the water continued to be drawn to the ponds.

In the late 1970s, an Original Process Waste Line (OPWL) break southeast of Building 774 resulted in a release of liquid that flowed around to the front of the building. Another, more detailed document reports that on July 21, 1980, an eight-year-old process waste line was discovered leaking southeast of Building 774. Process wastewater was observed seeping into the soil on the south side of the road southeast of Building 774. The leaking process wastewater flowed down slope, through a 30-ft culvert, along the east chainlink fence, and under the fence at the corner. From this point, the liquid flowed under the unpaved access road into a boggy area, the 771/774 Footing Drain Pond, north of Building 774 (PAC 700-1108). The vegetation in the boggy area was damaged where the spilled liquid formed a pool. It was estimated that approximately 1,000 gallons had leaked from the process waste line.

The initial response to the July 1980 incident was to stop the flow through the waste line causing the leak to stop. When the soil dried, a Field Instrument for the Detection of Low-Energy Radiation (FIDLER) survey was conducted and verified that the flow did not go beyond the 771/774 Footing Drain Pond. On July 24, the broken waste line was excavated and the problem identified as a loose flange. Soil excavation began July 28, 1980; as soil was excavated, it was surveyed with radiation monitors.

Low-level radioactive wastes containing caustics and acids were released to the environment. Analysis of the spilled water from the July 1980 incident indicated 2,500 picocuries per liter (pCi/L) total alpha activity, 4,000 pCi/L gross beta activity, 10,000 milligrams per liter (mg/L) nitrate, and a pH of 12. Other than repair of the pipeline in 1973, documentation was not found for any other response to the leakage from the pipeline.

Triangle Area, IHSS 900-165

The Triangle Area is located east of the contractors' storage yard, which is east of the SEP (PAC 000-101) and bound by Spruce Avenue and the Northeast Perimeter Road. The area is referred to by many different names including SEP storage yard, Property Utilization and

Disposition (PU&D) storage yard, and 779-storage yard. Several incidents of leaking storage drums were noted and are described below.

Drums were first moved into the Triangle Area during the construction of a drum storage area north of Building 883. The contents of the drums stored in the area were recoverable plutonium-bearing wastes and residues. Scrap material awaiting plutonium recovery was also stored in the Triangle Area. Examples of the types of scrap stored are graphite molds, crucibles, combustible wastes awaiting incineration, incinerator ash heels, crucible heels, and Raschig rings. No sludges or oils were stored in the Triangle Area. Some drums contained dilute HNO_3 , which contributed to their corrosion.

In 1968, more than 6,000 drums were still being stored in the open field. High winds in the unprotected area blew over as many as 150 drums at a time. Drums containing fire waste from May 1969 were stored in the Triangle Area until they could be counted at Building 771. Some fire waste was returned to the Triangle Area for storage after being counted.

In 1969, leaks and spills were detected. Specifically, drums with dilute HNO_3 were stored directly on the ground for the winter of 1966/1967. The following spring, the drums were placed on wooden pallets and were to have been double-lined with polyethylene bags with rigid poly drum liners. Drums were stored on wooden pallets until 1971 when they were stored in cargo containers. In 1973, an effort was initiated to transfer all plutonium scrap to indoor storage. The drums were monitored and decontaminated according to the criteria used for spills in indoor processing areas. The leaking drums were put into cargo containers in 1973. In 1973, some of the cargo containers were noted to be leaking. Recovered radioactive soil was shipped off site. Additional soil contamination was discovered and eight drums of soil and palliative agents were shipped off site.

Radioactively contaminated salts from the SEP were often blown across the S&W Contractor Storage Yard (PAC 900-176) into the area and onto the drums. The integrity of drums was damaged by collected condensation and from being blown over by wind. In 1969, approximately 292 drums were discovered to be leaking. As a result, approximately 200 square ft (ft^2) of soil received high-level contamination.

In summer 1973, two drums containing incinerator ash heels leaked through the floor of the cargo container in which they were stored. After this leak the inside floors of all cargo containers were fibreglassed for added containment. Alpha surveys were performed when drums or cargo boxes were moved from the area. The surveys were limited to the area where the drum or box had been. In addition, alpha and gamma surveys of the entire area were conducted in August 1974. The first FIDLER survey was probably performed in September 1974 and surveys continued until mid-1975. Surveys were performed periodically since then and areas of soil were removed as appropriate.

In June 1973, 200 yd^3 of plutonium-contaminated soil were temporarily stored in the eastern side of the Triangle Area. The soil came from the excavation of waste storage tanks near Building 774 (PAC 700-146). In September 1973, the 200 yd^3 of plutonium-contaminated soil were removed to the Present Landfill (PAC NW-114).

S&W Contractor Storage Yard, IHSS 000-176

The S&W Contractor Storage Yard lies approximately 50 ft east of the SEP in the vicinity of Building 964. The site is approximately 290 by 390 ft in area, according to the Interagency Agreement (IAG) (DOE et al. 1991); however, based on aerial photographs, the actual area used for storage appears to be considerably larger.

Since 1970, the storage yard has been used for storage of contractor materials used in various projects at the Site. Drummed storage occurred from 1970 to 1985. Containers were stored in numerous areas at the site throughout this time. The amount of waste stored is unknown. Containers were placed directly on the ground surface or on pallets.

In 1985, materials that qualified as hazardous waste were identified in several areas. Sampling and analysis of the drummed waste determined that the components were primarily mineral spirits, water, waste oil, volatile organic compounds (VOCs), and metals. The drums were removed and disposed of as hazardous waste. Since then, most of the area has been used for storage of surplus or raw materials for construction or maintenance projects.

As part of an initial soil characterization program in 1988, soil samples were collected from 10 locations at the site. Analysis of soil samples collected from borings in the area indicated levels of methylene chloride and acetone above the detection limits, although both were also detected in the sample blanks. Inorganics detected include aluminum, arsenic, barium, beryllium, chromium, sodium, thallium, calcium, cadmium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, vanadium, zinc, strontium, and nitrate/nitrite. Radionuclides detected include gross alpha; gross beta; tritium; americium-241; plutonium-239 and -240; and uranium-238, -233, and -234 (DOE 1992b).

Groundwater sampling was conducted at several wells in the vicinity of IHSS 176, both upgradient and downgradient of the IHSS. Inorganics and radionuclides detected in the groundwater beneath IHSS 176 that were not detected in upgradient samples are cobalt, mercury, potassium, zinc, carbonate, gross alpha, and strontium-90.

Data collected at this IHSS during the OU 10 Phase I RFI/RI are included in the IA Data Summary Report (DOE 2000a). Methylene chloride, acetone, aluminum, arsenic, calcium, cadmium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, vanadium, zinc, nitrate/nitrite, americium-241, plutonium-239/240, uranium-238, and uranium-233/234 were detected in surface soil above background values.

ITS Water Spill (formerly 000-502), PAC 900-1310

A release of approximately 490 gallons of interceptor trench water was reported at 1:45 AM on November 30, 1992. Surface water runoff and potentially contaminated groundwater are collected in the ITPH system prior to being pumped from a centralized sump into the Pond 207-B North. The release originated from a separation of a pipe coupling in the 3-inch transfer line on the east slope of the Pond 207B North berm and flowed onto the surrounding soil. The 3-ft section of drain hose that was connected to the end of the inlet pipe to the pond had frozen during several days of sub-zero weather and caused back pressure in the pipe when the interceptor central sump began to pump water into the pond.

Previous analytical testing indicated that listed hazardous waste constituents were detected in the interceptor trench water. A sample of the water was collected on November 30, 1992, and preliminary results indicate that chromium, lead, mercury, silver, carbon tetrachloride, and trichloroethene (TCE) were detected.

The pipe connection was repaired and the system was placed back into service. The released material was not directly recoverable because it soaked into the soil. Due to the location of the release (upgradient of the ITPH system in an area previously identified to be possibly contaminated by past releases from the proximal SEP), no action was taken to immediately recover the material.

GROUP 000-2

Original Process Waste Lines IHSS 000-121

The OPWL is a network of tanks and underground pipelines designated as IHSS 121. There are approximately 6 miles (35,000 ft) of underground pipelines that carried process waste from facilities generating waste to the Building 774 treatment facility. The OPWL was placed into service around 1952 with repairs and additions made to the system through 1975 (DOE 1992a).

Between 1975 and 1984, the OPWL was replaced by the separate, double-contained New Process Waste Lines (NPWL). Some of the tanks and pipelines from the OPWL were removed, other lines were incorporated into the NPWL, and some tanks were converted into the plenum deluge system. The OPWL that was not replaced or removed remains in place and consists of 66 pipeline segments and 5 pipeline spurs. Most of the OPWL is located in highly congested areas with other active and inactive utility lines. Approximately 13,000 ft of pipeline is beneath buildings, with another 7,000 ft beneath asphalt or concrete. There are few engineering drawings for the OPWL, and, in some instances, the drawings that were found contain contradictory information (DOE 1992a).

The pipelines range from 1 to 10 inches in diameter and are constructed of a variety of materials including black iron, cast iron, plastic, polyethylene, vitrified clay, cement/asbestos, saran-lined steel, stainless-steel, fiberglass, PVC, Pyrex, and Teflon. Concrete valve vaults provided access for operation and maintenance. These were included in the initial installation or added later at locations with persistent leaks such as at elbows, valves, and transitions from one pipe material to another (DOE 1992a).

The OPWL was not a continuous flowing system. Wastes were accumulated in holding tanks within the buildings, then transferred to Building 774 in batches, generally by gravity feed. The wastes transported were various aqueous process wastes containing low-level radioactive materials, nitrates, caustics, and acids. Small quantities of other liquids were also handled including medical decontamination fluids, miscellaneous laboratory wastes, and laundry effluent. These process waste streams also contained metals, VOCs, oil and grease, and cleaning compounds (DOE 1992a).

Leaks and releases are expected or confirmed at many locations within the OPWL (refer to figures of the IABZSAP). However, there is little characterization information available at this time.

Valve Vault West of Building 707, IHSS 700-123.2

In December 1958, a leak occurred at an OPWL elbow in the valve vault located west of the present location of Building 707. Process waste followed the containment pipe and flowed into a ditch to the northeast of the present location of Building 707. Up to 4,050 gallons of process waste were released. Leaks occurred in the elbow connections of the OPWL due to joint expansion following the introduction of steam condensate from Building 881. The elbow was repaired and the line remained in use for another 10 years. In March 1973, this valve vault was replaced as part of an upgrade program for this section of the OPWL system. Interviewees for the Comprehensive Environmental Assessment and Response Program (CEARP) Report (DOE 1986) indicated that this vault overflowed a number of times prior to 1973.

The liquid released contained uranium, solvents, oil, beryllium, HNO_3 , HCl acids, and fluoride. A soil sample collected at the valve vault west of Building 707 in 1976 indicated 54 mg/L nitrate and 0.145 disintegration per minute (dpm) plutonium. No documentation was found that further details response to this occurrence or other occurrences at this location.

Building 123 Process Waste Line Break, PAC 100-602

On April 13, 1989, Valve Vault 17, located on Cottonwood Avenue between Buildings 443 and 444, was found flooded with approximately 1,200 gallons of aqueous waste. Subsequent investigation showed the source of the waste was a break in the process waste line in Manhole 1, south of Building 123. Leakage from the break had migrated into bedding material surrounding the pipe and ultimately reached Valve Vault 17 through either pipe bedding materials (that is, soil), or a PVC electrical conduit. The release also migrated into a section of the abandoned OPWL network (PAC 000-121). Discharge of Building 123 process waste into the broken line was discontinued on April 18, 1989, five days after the release to Valve Vault 17 was first detected. The potentially affected area includes the process waste line between Manhole 2 and Valve Vault 18 (immediately south of Building 123), the process waste line between Valve Vaults 18 and 17, soil around Valve Vaults 18 and 17, and the OPWL between Manholes 2 and 3. In July 1989, groundwater containing blue dye, used several months earlier to trace the release, was observed seeping into excavations around Valve Vault 18. According to one report, the release may also have reached the storm sewer system. Numerous detailed reports address these actions.

The release consisted of Building 123 process waste. Based on typical daily quantities of wastes discharged from Building 123, the following materials were likely released to the environment:

- 25 gallons urine;
- 12.5 gallons HNO_3 (unknown concentration);
- 20 gallons HCl (unknown concentration);
- 1.5 pounds ammonium thiocyanate;
- 1.0 pound ammonium iodide; and

- 2.5 gallons ammonium hydroxide (unknown concentration).

The above materials would have been diluted in approximately 2,000 gallons of tap water.

Minor amounts of naturally occurring uranium were detected in soil and water samples collected after the release. Up to 140 pCi/L alpha activity was recorded in samples of the waste from Valve Vault 17. One water sample from a manhole south of Building 123 also contained 8 percent ethylene glycol.

After process waste discharge to the broken line was discontinued, soil sampling was conducted to determine the source and extent of the release. A temporary aboveground line was installed, and a replacement underground line was planned for completion by June 1, 1989.

Because the affected areas were near existing IHSSs scheduled for investigation and remediation activities (see PAC 400-122 and PAC 100-148), no cleanup was initiated. The release was documented in RCRA Contingency Plan Implementation Report (CPIR) No. 89-003 and in Rocky Flats Plant Internal Investigation Report (IIR) No. 89-55.

Tank T-29 - OPWL IHSS 000-121

Tank T-29 is located in the 700 Area northeast of Building 776 and east of the cooling tower. Tank T-29 is a 200,000-gallon carbon steel aboveground storage tank (AST). A valve vault on the north side of Tank T-29 was also sampled.

Tank T-29 was installed in 1952 and was reportedly abandoned in the mid-1980s. The tank was used to store untreated process waste from Building 774, including acids, bases, solvents, radionuclides, metals, chlorides, oils, and grease. No reported releases from this tank are known. As part of the OU 9 Phase I RFI/RI radiological surveys, soil sampling and tank sampling were conducted.

Three HPGe survey locations surrounding Tank T-29 showed elevated activities of uranium-238 (0.01%, 0.01%, and 2.5%) and uranium-235 (all three at 0.01%). Thorium (Th)-232 was slightly elevated at 0.01% at one station and americium-241 was elevated at 0.01% at all three locations. Plutonium-239/240 was also elevated at 0.01%.

Three of the 48 sodium iodide (NaI) survey sites around Tank T-29 were above background levels. NaI activities ranged between 1,900 and 3,000 counts per minute (cpm) with background levels in the same range.

A direct radiological survey of the interior of Tank T-29 for fixed and removable beta/gamma activity revealed 45,456 dpm/100 square centimeters (cm^2) at the plane of the opened inspection port. Activity dropped to 2,841 dpm/100 cm^2 at 8 inches above the port. The valve vault on the north side of Tank T-29 shows areas of fixed and removable alpha contamination. The northeast quadrant of the manhole cover had 208 dpm/100 cm^2 fixed and removable alpha contamination, and the concrete pad had 210 dpm/100 cm^2 fixed and removable alpha contamination.

Two soil samples were collected and analyzed during the OU 9 Phase I RFI/RI. americium-241, gross alpha, plutonium-239/240, copper, and silver were detected above background values. Methylene chloride was the only organic detected above 1.0 microgram per liter ($\mu\text{g/L}$).

Four boreholes were drilled around Tank T-29. Americium-241 and plutonium-239/240 were detected above background, at a depth of 0 to 6 inches in all four boreholes. Lead was detected above background concentrations in the western, eastern, and southeastern boreholes. Methylene chloride was the only VOC detected, at a level of 1 microgram per kilogram ($\mu\text{g/kg}$). Cadmium and silver were detected above background in the eastern borehole.

A liquid sample was collected at the Tank T-29 vault. Gross beta, uranium-233/234, and uranium-235 had elevated activities and americium-241, gross alpha, plutonium-239/240, and uranium-238 had significantly elevated activities. There were also elevated levels of metals including arsenic, barium, beryllium, cadmium, copper, silver, strontium, and vanadium. There were significantly elevated levels of iron, lead, manganese, potassium, sodium, and zinc.

Radiological samples of Tank T-29 showed results for removable alpha and beta contamination on the base of the tank ranging from 2,970 to 6,020 dpm/100 cm^2 for alpha and less than 200 to 263 dpm/100 cm^2 for beta. The sides near the base of the tank had significantly lower removable activities.

These data are available IA Data Summary Report (DOE 2000a).

Tank 31 - OPWL IHSS 000-121

There are no existing data on Tank 31.

Low-Level Radioactive Waste Leak, IHSS 700-127

Persons interviewed for the CEARP recalled construction activities near Building 774 and west of Pond 207-C that resulted in breaking a low-level radioactive waste discharge line several times. This line carried liquids from the process waste treatment facility (Building 774) to the sanitary waste water treatment plant (Building 995).

On October 14, 1957, a line that carried process waste between Building 774 and a 200,000-gallon waste holding tank (Tank 207) leaked at a joint. It was determined that the joint had not been properly packed during construction. The joint was repaired and the excavation backfilled by November 5, 1957.

Another leak was detected in 1971 when the waste line between Building 774 and Building 5 was pressure tested. The liquid waste that flowed from Building 774 to Building 995 was high in nitrate and had small amounts of plutonium. Tank 207 was used at that time to store unprocessed liquid waste for later treatment in Building 774. A soil sample collected in 1976 from a depth of 4 ft beside the leak area, north of Tank 207 and south of Building 774, was analyzed and found to contain 76 mg/L nitrate and 1.83 disintegrations per minute per gram (dpm/g) plutonium.

In April 1982, the leaking section of line was replaced.

The location of IHSS 127 defined in the IAG does not correspond with the location of any process waste lines located on RFETS utility drawings. Information gathered for the HRR indicates the location of the process waste line between Building 774 and Building 995 is approximately 70 ft west of the previously identified IAG location for IHSS 127. It was proposed that the location of IHSS 127 be redefined to coincide with the location of the process waste line discussed as PAC 700-127.

Process Waste Line Leaks, IHSS 700-147.1

On September 27, 1955, a possible leak in the OPWL north of Building 881 was reported. Approximately 1 ft of process waste water was present in a manhole. In June 1959, monitoring and environmental samples showed low-level contamination along the OPWL from Building 881 to Building 774. In February 1960, the OPWL from Building 880 ruptured, releasing waste in the construction area near Building 777. On October 27, 1964, there was a break in the OPWL from Building 881 to Building 774 and process waste water was pumped into a ditch around the parking lot. In October 1964, an excavation was made in the 776 parking lot. In November 1964, contaminated liquid wastes were released into the sanitary sewer due to breaks and leaks in the process waste line from Buildings 441, 444, 881, and 883.

A May 1971 report stated that the transfer line from Building 444 and Building 881 to Building 774 had broken and leaked several times during the past 20 years. The leaks generally occurred east of Eighth Street and north of Central Avenue. The report states that nitrate migration in the soil from the leaking transfer line was traced by samples collected from shallow wells. During summer 1984, the process waste line connecting Building 881 to Building 374 cracked. The break occurred approximately 150 yards south of the Guard Gate into the Building 777 complex. Approximately 2 yards of contaminated soil were removed during the cleanup process.

Groundwater samples collected from monitoring wells located at various points east of where breaks had occurred indicated several hundred parts per million (ppm) nitrate. Typical constituents of waste discharged into the process waste system include uranium, plutonium, beryllium, acids, and solvents.

Radioactive Site 700 Area, IHSS 000-162

IHSS 162 is located along Eighth Street and extends from the southern end of Building 771 to the northern end of Building 850. Radiochemical activity was identified during groundwater monitoring activities in 1974. In response to this activity, Eighth Street was paved over to prevent mobilization of the affected material. In January 1981, an air sample collected during excavation activities at Eighth Street and Central Avenue yielded a long-lived alpha activity concentration, indicating the presence of residual activity in the area. Excavation crews were required to wet the surface soil prior to removal to reduce airborne dispersion of the soil (DOE 1992a).

No releases occurring in IHSS 162 south of the 700 Area are documented. However, there are at least 10 other IHSSs involving radioactive waste overlapping or in close proximity to this IHSS. According to the HRR, it is possible that releases in the surrounding IHSSs may

have affected this IHSS. Four previously sampled polychlorinated biphenyl (PCB)/radiological sampling locations lie within IHSS 162 or in the immediate vicinity. Analyses of samples collected at the northwestern and southwestern corners of Building 776 indicated PCBs in soil. Aroclor-1260 was found with concentrations ranging from 69 to 480,000 $\mu\text{g/kg}$ (EG&G 1991). A sample collected at the northwestern corner of Building 776 had an americium-241 activity of 6.8 pCi/g. Samples also indicated plutonium-239/240 and americium-241 were present at levels above sitewide background activities (DOE 1992a).

HPGe survey data for locations in IHSS 162 did not indicate elevated activities in southern portions of the IHSS. HPGe survey data at northern locations indicated elevated activities for Th-232, uranium-238, americium-241, and plutonium-239/240. The proximity to Building 569 may have influenced the measurements.

Twenty-three surface soil samples were collected in and around IHSS 162 as part of IA RFI/RIs. Organics, inorganics, and radionuclides were detected. These data are available in the IA Data Summary Report (DOE 2000a).

GROUP 000-3

Sanitary Sewer System, PAC 000-500

The RFETS sanitary sewer system has been used for transport, storage, and treatment of sanitary waste since RFETS began operations in 1952. Various drains, sinks, sumps, and latrines located in RFETS buildings discharge to central collection lines that transport the waste to the sanitary sewage treatment plant (Building 995). RFETS wastes, which are incompatible with sanitary sewage treatment, are designated process wastes and are handled in a separate system from sanitary wastes (see PAC 000-121, OPWL). In each RFETS building that generates process waste, waste discharge points (drains, sinks, sumps, and so forth) are designated as either sanitary waste or process waste receptacles, and are plumbed separately into the appropriate waste system. In some Plant facilities, wastes are, or have historically been, collected and temporarily stored in tanks plumbed into both systems, and transferred to the appropriate system based on analytical results. Sanitary sewer system sludges containing low levels of radionuclides were historically disposed of on site in burial trenches.

The Rocky Flats Plant (RFP) historically discharged waste streams other than typical sanitary wastes to the sanitary sewer system. These discharges changed throughout the history of RFP in response to internal guidelines (in particular, U.S. Atomic Energy Commission [AEC] guidelines in the early history of RFP) and, increasingly during the past two decades, to state and federal regulations. Waste streams that were discharged to the sanitary sewer system include the following:

- Laboratory wastes from Building 123;
- Waste from Building 331;
- Laundry waste water from Building 442;
- Film process bath water, employee wash water, and chromic acid from Building 444;

- Chemicals from Building 559;
- Acids from Building 705;
- Laundry waste water from Building 771;
- Low-level aqueous waste from Building 779;
- Laundry waste water and other unknown water from Building 881;
- Water from employee restrooms from Building 883; and
- Acids, bases, and solvents from Building 991.

In addition to routine or planned sanitary sewer discharges, unplanned incidental discharges have occurred as a result of equipment failure, overflow or spillage of materials, or accidental discharge of process wastes into sanitary waste receptacles.

In some cases, buildings plumbed into the sanitary system at the time of their construction have later added facilities or processes that generate process waste, and have discharged this waste into the sanitary sewer system for a period of time. Incidental or accidental sanitary sewer discharges include the following:

- Oil discharges;
- Laundry waste water;
- Foundry coolant water;
- Hexavalent chromium waste;
- Process wastes:
- Sulfuric acid;
- Silver paint;
- Demineralization waste;
- Medical waste;
- Steam plant boiler blowdown and steam condensate;
- Dye;
- Nitric acid;
- Ethylene glycol; and
- Acids.

Two major incidents involving the sanitary sewer system for which detailed documentation is available are discussed below.

An estimated 50 to 100 curies of tritium were inadvertently released from Building 779 to the sanitary sewer system in April and May 1973. The tritium originated from a shipment of scrap plutonium metal received at RFETS for reprocessing. During reprocessing activities in Building 779, the tritium was separated from the plutonium and became part of the aqueous reprocessing waste. This waste was stored in accumulation tanks in Building 779, which discharged either to the sanitary sewer system or the process waste system, depending upon analytical characterization of the waste. Because tritium was not expected in these wastes, it was not targeted by the predischage analyses, and tritium-contaminated wastes were released into the sanitary sewer system. One release contained an estimated 6 curies of tritium in 7,800 gallons of waste, and a second release contained an estimated 44 curies in 8,000 gallons of waste. These releases flowed to Building 995, and were then discharged as sanitary system effluent to the B-series holding ponds and eventually off the RFETS site.

In late February 1989, chromic acid stored in Building 444 for use in plating operations overflowed tanks and a containment berm and entered the building's foundation drains. The spill collected in a sump and was automatically transferred by a sump pump into the sanitary sewer system. The spilled material was observed intermittently in Building 995 over the next two days, but was not identified as chromic acid until five days later. Part of the spilled material was discharged in sanitary system effluent to the B-series ponds. As a result, an estimated 30 pounds of chromium were released to the sanitary sewer system. This incident was documented in RCRA CIPR 89-001.

A 1967 survey indicated that the sanitary sewer system total daily flow averaged 250,000 gallons, of which an average 21,000 gallons were laundry waste. A 1973 investigation of plutonium releases to the sanitary sewer system indicated that 88 percent of the plutonium at that time originated from laundry waste.

Photographic processing solutions were discharged to the sanitary sewer system according to the following discharge limits provided in a 1977 document: 13,000 pCi/L tritium, 5 pCi/L plutonium; 10 pCi/L uranium; and 1.0 ppm beryllium.

Monthly estimates of total radioactivity discharged to the sanitary sewer system in Building 442 laundry wastes were summarized during the early history of RFETS in Site Survey Monthly Reports.

Storm Drains, PAC 000-505

There are 239 storm drains at RFETS. The storm drains provide Site drainage from roads, parking lots, and other areas, discharging into the creeks and drainages north and south of the Site.

The storm drains were designed to convey surface water away from the Site, but unplanned accidental discharges to the system have occurred. Several incidents were reported and include the following (described in detail below):

- Potential contamination at the Building 771 storm drain;

- Wash water from the degreasing of depleted uranium parts near Building 991;
- Release of HNO_3 /nitrad waste solution from Building 460;
- Release of miscellaneous materials into the storm drain west of Building 446, PAC 400-803 (DOE 1992a);
- PCB runoff from Building 707;
- PCB runoff from the Building 444 courtyard; and
- Building 776 storm drain.

Various waste liquids from laundry and decontamination facilities, the analytical laboratory, radiography sinks, and runoff from the Building 771 roof and ground areas were discharged into the Building 771 storm drain from 1953 until mid-1957. Periodic releases from laundry holding tanks occurred until 1965. Radionuclide concentrations in soil ranged from 130 to 2,000 dpm/g, and in sediments from 60,000 to 200,000 dpm/g.

Cleaning operations were performed on depleted uranium parts in the open courtyard of Building 991 during the late 1950s and early 1960s. Parts were degreased with acetone and other organic solvents. Spills and water wash-downs were flushed into the storm drains that discharged into South Walnut Creek.

In April 1989, between 5 and 7 gallons of HNO_3 /nitrad waste solution from Building 460 entered a storm drain that feeds into Pond C-2. Miscellaneous materials, including silver paint and possibly oil and aluminum paint, were dumped into the storm drain immediately west of Building 446 (DOE 1992a).

The Building 371 storm drains and ditches were sampled in 1987. The results of sample analysis were gross alpha at 24 ± 8 pCi/L and gross beta at 64 ± 4 pCi/L in the storm drains. In September 1970, two 55-gallon drums of contaminated soil were removed from the Building 771 storm drain area and additional soil was removed in February 1971. At least 50 drums of contaminated soil were eventually removed. The remaining soil was surveyed and results ranged from 120 to 3,000 dpm/g.

Old Outfall - Building 771, IHSS 700-143

When Building 771 went into operation in 1953, some waste liquids passed through a storm drain, located north and west of the building, and into North Walnut Creek. The main source of waste liquids was outfall from the Building 771 laundry holding tanks. Other sources included the analytical laboratory and radiography sinks, personnel decontamination room, and runoff from the roof of Building 771 and the ground areas.

Waste liquid from the Building 771 laundry holding tanks were discharged to this drain if the plutonium concentration was below 3,300 disintegrations per minute per liter (dpm/L). Between mid-1953 and mid-1957, 4.5 million gallons of liquid were released containing a total of 2.23 millicuries (mCi). In 1957, a waste line was completed that allowed an option of releasing these liquids to the Building 774 release below Building 995 (PAC NE-142).

However, due to equipment problems, periodic releases from the laundry holding tanks to the 771 outfall continued until 1965. During this period, 430,000 gallons were released containing 0.25 mCi.

Other release sources for the 771 outfall went directly to the storm sewer system and there is no documentation of the liquid quantity or quality. These are described below.

- On April 9, 1958, it was noted that a decontamination sink was tied into a process waste drain that emptied into Walnut Creek north of Building 773.
- In May 1971, a sewer line break resulted in storage tanks overflowing through the 771 outfall.
- During the week ending August 4, 1978, a hot spot approximately 875 ft² was found near a culvert northwest of the Building 771 parking lot.
- Plutonium-contaminated waste water that also contained soaps and detergent originated from the Building 771 laundry, analytical laboratory, and radiography areas and a decontamination sink.

In addition to the water released from Building 771, a soil-stabilizing solution was frequently applied during remedial activities in 1971. The stabilizer was a mixture of water, ethylene glycol, and Dowell J-197 soil stabilizer.

As early as 1953, contamination at the outfall was measured at 17,400 dpm/g in the soil. Contamination of soil at the discharge was reported in May 1956 with the highest sample activity being 130 dpm/g gross alpha.

Remediation activities at IHSS 700-143 are detailed below.

"Initial discovery" of the spot occurred in April 1970; sample results indicated plutonium at levels greater than 190,000 dpm/g. The area was subsequently subject to frequent soil sampling and some monitoring with direct counting instruments. The sampling continued throughout the remediation process. Soil sample activities ranged from 28,621 to 229,290 dpm/g plutonium on October 19, 1970 (prior to soil removal activities). On February 18, 1971, activities ranged from 47 to 4,437 dpm/g plutonium during soil removal. Sampling of water in April 1970 indicated gross alpha activity of 12 dpm/L draining through the effluent pipe.

In August 1970, it was reported that a 12-inch drain line used for the disposal of rain and underground water was slightly contaminated where it drained into McKay Ditch. An investigation indicated that an overflow pipe from the laundry had been accidentally piped into this line. The plumbing was corrected and contaminated soil and foliage was removed and drummed as low specific activity (LSA) waste.

In September 1970, approximately 75 cubic ft (ft³) of contaminated soil was removed from the area. Another document states that in September, two 55-gallon drums of contaminated soil were removed.

In January 1971, the Health Physics Operations Group Technical and Construction Report stated that recent instrument surveys taken in the ditch indicated that the prior removal of two drums of soil and vegetation was insufficient. The removal resumed in February 1971. As of February 18, 1971, there were no known open drain lines from the building to the outfall.

A letter dated February 19, 1971, requested that the drain pipe to the outfall be capped. However, because the water running out of it was not contaminated at that time and it was being checked daily by Health Physics, the pipe was not capped.

As of February 26, 1971, approximately 350 ft³ of contaminated soil from an area approximately 750 ft² was removed and drummed. It was believed that no contamination had been spread by the wind because the outfall was in a depression approximately 20 ft deep at the bottom of a hill, the soil was constantly moist, and the area was covered with grasses and cattails.

The Health Physics Monthly Status Report for the month of February 1971 reported that 20 soil samples collected from McKay Ditch indicated that the plutonium contamination was localized and did not travel downstream.

In early March 1971, water collected from the effluent pipe at the outfall was analyzed and found to have gross activity of 9.60 pCi/L. A typical RFETS water sample activity averaged approximately 40 pCi/L at the time.

Operations during May 1971 consisted of transferring contaminated mud from 23 used drums to new drums with provisions to absorb any contaminated liquid. Digging was to be resumed as the weather improved and the mud dried. By August 31, 1971, the removal of soil was complete and 149 drums were shipped as hot waste (presumably off site, but this was not specified in the associated documentation). Cement was added to each drum before and after filling to absorb any contained liquid. The contaminated area was approximately 800 ft² with contamination as deep as 3.5 ft in one small area. The maximum soil sample result was 39,000 dpm/g. Final survey of the area indicated maximum alpha counts of 250 cpm. Final soil sampling averaged 34 dpm/g with a maximum of 150 dpm/g.

Soil found in the culvert in August 1978 was cleaned up during summer 1980. The removal was complete by July 18, 1980, resulting in nine boxes of contaminated soil.

The area that formally was the outfall culvert was filled in with soil and is now a paved parking lot for Building 771. Filling and parking lot construction occurred some time after the soil removal in 1980.

Central Avenue Ditch Caustic Leak, IHSS 000-190

On December 3 and 4, 1978, a bulk caustic storage tank leaked into its spill catch basin. Due to operator error, a sodium hydroxide (NaOH) solution flowed eastward down the Central Avenue Ditch and was diverted to South Walnut Creek and Pond B-1 for temporary containment. Approximately 1 to 3 gallons of concentrated caustic solution was involved.

In response to this incident, immediate steps were taken to isolate the contamination, treat the contaminated runoff, and divert drainage from adjacent areas. These steps included the following:

- Divert the 400-complex snowmelt water across the Central Avenue Ditch to the 700 Area drainage;
- Dam the upper Central Avenue Ditch above the B-Series ponds near the cattle fence;
- Divert Building 995 sewage effluent to Pond 207-B South, and retain Pond B-3 as a reserve pond;
- Rope off the upper portion of the Central Avenue Ditch;
- Pump the water from Pond B-2 to Pond A-2 and hold Pond B-2 as a last resort catch pond; and
- Neutralize Pond B-1 by adding 1,400 pounds of alum and then pump this liquid to Pond 207-B North.

Follow-up response activities to the December 1978 incident included:

- Neutralize the Central Avenue Ditch between Fifth and Tenth Streets by adding 5,000 pounds of alum;
- Complete final sampling of Pond 207-B North on approximately January 19, 1978;
- Monitor the pH of the ditch. On March 23, 1979, the ditch was no longer considered a problem and runoff from the ditch was allowed to be discharged off site;
- Blend liquid in Pond 207B-North with sanitary water and process it through the sewage treatment plant; then transfer to Pond 207-B South for processing through the reverse osmosis building and subsequent discharge off site;
- On approximately May 4, 1979, Pond 207-B North liquid was drained into Pond B-2; and
- On approximately June 29, 1979, the remaining liquid in Pond B-1 was declared environmentally acceptable and sprayed on the adjacent hillside.

The tank leak was identified and all repairs were completed. Furthermore, the incident was reviewed with all Stationary Operating engineers at the Central Steam Plant and they were directed to review all standard operating procedures on chemical handling and storage. An incident report was prepared.

On January 6, 1989, caustic solution was released from the same Building 443 tank involved in the December 1978 incident, into its secondary containment (spill catch basin). The outlet pipe and valve on the tank deteriorated to the extent that the pipe disconnected from the tank. Due to cold weather, the caustic froze which prevented further leakage. In response to the

January 1989 incident, the tank was temporarily repiped and emptied. The removed caustic was neutralized and transferred to Building 374 for treatment as a process waste.

GROUP 000-4

New Process Waste Lines PAC 000-504

The NPWL consists of a network of double-contained underground pipelines and tanks that transport liquid waste streams to Building 374, Waste Treatment Operations. The NPWL overlaps the OPWL in many places and, for the most part, replaces the OPWL infrastructure. Installation of the NPWL was completed in 1984. Some of the OPWL lines were converted to NPWL.

The NPWL transports a variety of waste streams to Building 374. These current and past waste streams include laundry water, nonradioactive/chemical laboratory waste, uranium and beryllium waste, PCBs, SEP water, incidental water, high nitrate waste from Building 774, and waste from Site laboratories and utilities. Potential contaminants of concern (PCOCs) include acids, bases, solvents, radionuclides, PCBs, metals, oils, and photographic laboratory chemicals.

Releases from NPWL were documented at several PACs and are summarized below:

- HNO₃, hydrofluoric acid, and HCl from Building 123 scrubber;
- Nitrate, radionuclides, and acids from Valve Vaults 11, 12, and 13; and
- Nitrate and radionuclides from process waste line leaks.

Spilled material from Building 123 was containerized and transferred into the Building 123 process waste system on November 7, 1989. Responses to occurrences at Valve Vaults 11, 12, and 13 have included repairing valve vaults and piping and removing contaminated soil. Contaminated soil from process waste line leaks was excavated and removed (DOE 1999).

GROUP 000-5

Present Landfill, IHSS 114

The Present Landfill is located in a natural drainage tributary to North Walnut Creek, approximately 560 ft north of the 700 Area (Figure 2 of the IABZSAP). The landfill was constructed in August 1968 for the disposal of uncontaminated solid. The landfill was used for the disposal of general RFETS refuse collected from various locations throughout the Plant. Wastes include paper, rags, floor sweepings, cartons, demolition material, and miscellaneous items. Routine operation of the landfill included the disposal of sanitary wastewater treatment plant sludge, asbestos, and PCBs.

Radioactively contaminated sludge from the sanitary wastewater treatment plant (Building 995) was routinely disposed of at the landfill from August 1968 through May 1970. The contamination consisted of uranium and plutonium, which had entered the sanitary sewage system with laundry water. Approximately 2,200 pounds of sludge containing an estimated 8

milligrams of plutonium were buried in the landfill. This sludge also contained depleted uranium. This practice was discontinued in May 1970 when off-site shipment of sludge as low-level waste (LLW) began. Other sources include nonradioactive sludge from the Reverse Osmosis Plant, sludge from the Building 373 cooling tower, and dried sludge from the Sewage Treatment Plant (DOE 1992a).

In 1985, asbestos was disposed of in a designated area, which consisted of a 10-ft-deep pit. Warning signs were displayed at the entrance to the disposal area and at a distance of 100 ft around the asbestos disposal pit. By December 1988, asbestos was disposed of in several pits in specified areas near the center of the landfill. The approximate locations of these areas were marked with asbestos warning signs to comply with appropriate regulations (DOE 1992a).

Small quantities of PCB-containing materials (for example, used fluorescent light ballasts) were routinely disposed of in the landfill. A cargo container located in the currently inactive hazardous waste storage area (PAC NW-203), west of the landfill, was used for PCB storage prior to off-site disposal (DOE 1992a).

Other nonroutine incidents of waste disposal in the landfill include disposition of a mercaptan (odor additive to natural gas) tank, tear gas powder, a drum of solidified polystyrene resin used in fiberglassing, soil contaminated from a release of approximately 700 gallons of No. 6 fuel oil in the 600 Area (PAC 600-152), burning of chromium-contaminated wood (from the Building 444 cooling tower) near the landfill in May 1975, dumping of unknown chemicals, unknown reactive chemical residue, and aluminum oxide (DOE 1992a).

Hazardous waste that routinely went to the landfill is grouped into four categories: (1) containers partially filled with paint, solvents, and foam polymers; (2) wipes and rags contaminated with listed hazardous wastes; (3) filters, typically including silicone oil filters, paint filters, and other miscellaneous filters that may have contained hazardous constituents; and (4) metal cuttings and shavings, including mineral and asbestos dust and metal chips coated with hydraulic oil and organic solvents. Disposal of hazardous constituents ceased in fall 1986 (DOE 1992a).

Characterization activities at the Present Landfill confirm contamination above Tier II SALs in subsurface soil, surface soil, and sediment. Several subsurface soil samples contained concentrations above the Tier II SSALs for benzo(a)pyrene, methylene chloride, and TCE.

GROUP 100-1

Medical Facility, UBC 122

Current information on Building 122 is from WSRIC (RMRS 2000a); information on past activities is from the HAER (DOE 1998a).

Building 122 houses the on-site medical facilities of the Plant and the occupational health and internal dosimetry organizations. Emergency medical services, diagnosis, decontamination, first aid, x-ray, minor surgical treatment, and ambulatory activities are carried out in this building. The building also contains clinical and examination facilities to

support routine employee and subcontractor physical examinations. Body counting to measure radioactive material in the body is also conducted. The facility contains three general areas: administration, internal dosimetry, and medical/health.

Building 122 went into service in 1953. One of the services performed in Building 122 was to remove metals from the blood stream of exposed employees, using a procedure called "chelation therapy." This procedure used a variety of techniques; however, early success rates in removing metals such as plutonium and uranium were limited. Several research studies, which are described below, were conducted at Building 122.

The subject of one study was the interaction of a solvent with plutonium. The study determined that the solvent combined with plutonium allowed toxic exposure through a dermal pathway. As a result of the study, the solvent was not approved for use, preventing what could have become a significant health risk for employees.

Cytogenetic studies performed at the Plant resulted in a method to calculate plutonium exposure by measuring cell damage, and identify beryllium exposure by the identification of beryllium antibodies.

Two medical studies were begun to monitor the long-term effects of exposure to beryllium and radioactive materials such as plutonium, enriched uranium, americium, and others.

In addition to research studies and providing medical care to Site workers, personnel in Building 122 were involved in research and development of radiation detection equipment. The first patent awarded at the Plant was for a radiation wound counter to detect and quantify the presence of radioactive materials inside a wound.

Another significant item developed by medical building personnel was the body counter. This equipment was extremely sensitive, and detected minute amounts of radiation emanating from a person as a result of inhalation of radioactive particles.

Tank T-1 - OPWL - Underground Stainless-steel Waste Storage Tank IHSS 000-121

The Tank T-1 source area is located in the 100 Area, along the southern side of Building 122 near the southeastern corner. Tank T-1 was an 800-gallon, stainless-steel underground tank that was installed in 1955 and then removed in January 1984. It held waste streams from Building 122, the Medical Facility, including wastes such as trace radionuclides and decontamination water with constituents such as bleach, soap, blood, and hydrogen peroxide. This former tank area has been identified as a known release location (DOE 1992b).

HPGe surveys near Tank T-1 provided no evidence of anomalous activity. Groundwater samples from a borehole 7 ft northwest of Tank T-1 indicated that levels of aluminum, arsenic, manganese, vanadium, americium-241, and plutonium-239/240 exceeded background concentrations.

Soil samples from a borehole on the center portion of Tank T-1 indicated that americium-241 and plutonium-239/240 were elevated above background at a depth of 4.0 to 4.9 ft. Groundwater sampling at the same location indicated that aluminum, arsenic, lead,

manganese, potassium, gross alpha, gross beta, americium-241, plutonium-239/240, radium-226, and uranium-233/234/238 exceeded background concentrations at a depth of 3.0 ft.

IHSS GROUP 100-2

Standards Laboratory, UBC 125

Information on Building 125 is from WSRIC (RMRS 2000b) and the HAER (DOE 1998a). Building 125 houses the Standards Laboratory, offices for Metrology Laboratory management personnel, and the Metrology Systems Group. The Standards Laboratory, a function of Metrology, consists of several component labs, including physical, dimensional, chemical, and electrical. The Standards Laboratory provides National Institute of Standards and Technology-traceable calibration equipment and standards for the Measurements and Test Group.

The primary function of the Standards Laboratory is to ensure and implement a system of quality control (QC) for incoming materials used in manufacturing processes. The Standards Laboratory is used to prepare stock solutions for the other labs, and perform analyses on incoming radiological sources for quality assurance (QA)/QC purposes.

IHSS GROUP 100-3

Building 111 Transformer PCB Leak, PAC 100-607

A large electrical transformer is located inside the Building 111 basement. The transformer held approximately 500 gallons of cooling oil that contained PCBs. This transformer was first documented as leaking onto the underlying gravel in February 1984.

On January 30, 1986, the U.S. Environmental Protection Agency (EPA) conducted a survey of RFETS to determine compliance with federal PCB regulations. The inspection identified a number of leaking transformers, including the Building 111 transformer. Follow-up inspection by RFETS indicated that leaks originated at the transformer's tap changer and oil sample valve.

An unknown amount of PCB-bearing cooling oil leaked from the transformer between February 1984 (possibly earlier) and early to mid-1986. It is not known whether the leaks during this period were continuous or intermittent. Samples of the oil collected in early 1984 indicated 17 ppm Aroclor 1260, a commercial PCB formulation, in a paraffin-based mineral oil.

Samples collected in early 1984 indicated that PCB levels in the cooling oil were below the EPA regulatory limit of 50 ppm. No corrective actions were documented at that time.

Available documents suggest that the Building 111 transformer was cleaned and repaired in August 1986. Documentation suggested the transformer was scheduled for replacement in 1987 or 1988. Residual staining on the transformer concrete pad was noted in January 1987, and it was suggested at that time that the pad be coated with sealant.

IHSS GROUP 100-4

Health Physics Laboratory, UBC 123

UBC 123 is located on Central Avenue between Third and Fourth Streets and consists of the Building 123 slab. The building footprint is approximately 18,444 ft². Building 123 went into service in 1953 and housed the Radiological Health Physics Laboratory which analyzed water, biological materials, soil, air, and filter samples for the presence of plutonium, americium, uranium, alpha radiation, beta radiation, gamma radiation, tritium, beryllium, and organics. Additionally, personnel radiation badges were counted and repaired. Low-level liquid and chemical wastes were generated at this location and transferred to treatment systems via the process waste line system. The process waste systems at this location consist of underground pipelines composed of steel, polyethylene, cast iron, and other materials, and sumps and pumps. PCOCs beneath the slab are uranium, plutonium, cesium, metals, and VOCs (DOE 2000b).

The D&D of Building 123 and the surrounding area was completed in 1998. The project included the removal of Buildings 123, 123S, 113, and 114. The Building 123 floor slab was sampled to assess potentially contaminated areas. Areas of the slab that could not be decontaminated to unrestricted release were encapsulated with epoxy paint to fix any removable contamination and covered with steel plate. The building slab and process waste lines were left in place. Several source storage pits of various dimensions were used to store radioactive sources and are also present beneath the slab. All of the pipelines were grouted at slab level (DOE 2000b).

Waste Leaks IHSS 100-148

The eastern wing of Building 123 is encompassed by IHSS 148. Building 123 was constructed as a laboratory and was one of the first buildings at RFETS. When constructed, the building consisted of a north wing running east-west and an east wing running north-south. A west wing running north-south was added onto the western end of the north wing in the late 1960s (probably 1968) and an addition to the southern end of the east wing was added in approximately 1972.

Persons interviewed for the CEARP Phase 1 document indicated that several small spills of nitrate-bearing wastes occurred around the outside of Building 123. These wastes may have contained radionuclides. Additionally, interviewees indicated that there were potential releases of nitrate-bearing wastes from the OPWL buried beneath Building 123. This pipeline was in use from the start of operations in Building 123 until the OPWL was replaced by the NPWL. The abandonment of the OPWL beneath Building 123 occurred no later than February 1975 when engineering drawings documented the abandonment of the OPWL system.

Building 123 was serviced by a 4-inch-diameter process waste line buried beneath the north and east wings of the building. The main process waste line drained from west to east in the north wing, and from north to south the east wing. The pipe was sloped at 1 percent. A number of connections were made to the main pipe, some of which consisted of headers servicing a number of process waste drains in the building. The pipe was probably constructed of a type of iron called "Duriron." The OPWL piping from Building 123 led to an underground tank system behind Building 441 that collected wastes generated by both

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Buildings 123 and 441. From this tank system, the process waste materials were pumped out for treatment in the process waste system.

The OPWL drain was not double-contained, and varied in depth beneath the floor of Building 123 from approximately 0.5 to 3 ft beneath the bottom of the concrete floor of the building. The line came out from beneath the southern end of the east wing of the building, with an invert elevation of approximately 6,032.5 ft. Interviewees have stated that this line, being constructed of a type of iron, probably leaked considerable amounts of waste without personnel aware of the leak. The types of waste consisted of laboratory wastes from analysis of urine, fecal, and other bioassay samples. Nitrates and low levels of radionuclides were associated with the wastes carried in the OPWL. The NPWL that replaced the OPWL consisted of either double-contained or overhead lines (DOE 2000b).

Surface soil samples were collected and analyzed as part of the OU 13 RFI/RI. Thirty-four analytes were detected in the surface soil samples, including 26 inorganic compounds and 8 radionuclides. Eleven analytes exceeded background concentrations at a minimum of one sampling location throughout IHSS 148. Constituents that exceeded background concentrations were chromium, cobalt, copper, lead, nickel, strontium, zinc, americium-241, plutonium-239/240, uranium-233/234, and uranium-238. These data are available in the IA Data Summary Report (DOE 2000a).

A soil gas survey was conducted on a 25-ft grid and samples were analyzed in the field using gas chromatography/mass spectrometry (GC/MS). Sixty-four soil gas locations were sampled and 13 samples contained VOC levels in excess of the 1 µg/L method detection limit (MDL). Benzene, toluene, ethylbenzene, xylene, and fuel constituents were detected in samples collected from the perimeter of Building 123 and within the east and west wings of the building. Trichlorofluoromethane (TCFM) was detected in nine samples distributed throughout the IHSS 148 area at levels up to 2.6 µg/L. Tetrachloroethene (PCE) was detected at 1.5 µg/L in a sample collected east of Building 123.

Unconfirmed reports of contaminant spills were indicated in interviews with building employees. In the late 1960s or early 1970s, a cesium-contaminated liquid was reportedly spilled on the concrete floor in Room 109. The floor was immediately sealed to immobilize the contamination. Room 109 also contained source storage pits. Undocumented thorium research was performed in Room 105. Scoping surveys conducted in May through July 1997 revealed elevated levels of radioactivity in both Rooms 105 and 109. In-situ gamma spectroscopic measurements performed in August 1997 indicated the presence of cesium-137 and Th-232 in Rooms 109 and 105, respectively (RMRS 1998).

Building 123 Bioassay Waste Spill, PAC 100-603

An underground process waste line from Building 123 was being excavated and replaced due to a break in the line (PAC 100-602). The excavated end of the broken line was temporarily capped with a plastic bag and Building 123 process waste was rerouted to bypass the broken line. A pump used to reroute the waste failed and allowed the waste to overflow into the broken line. Part of this waste leaked around the plastic bag and into the excavation.

The release consisted of bioassay waste containing HCl and HNO₃. The waste had a pH of approximately 1. The waste also may have contained urine, and up to a combined total of 1.5

gallons of ammonium thiocyanate, ammonium iodide, and ammonium hydroxide. The calculated maximum volume of the spill was 30 gallons. The released material mixed with rainwater in the excavation.

Potential flow from the excavation was contained with earthen berms. Approximately 100 gallons of rainwater contaminated by the spill were neutralized, pumped from the excavation, and transferred to the process waste system for treatment in Building 374. Samples were collected to evaluate the spread of contamination. The release was documented in RCRA CIPR No. 89-006.

Building 123 Scrubber Solution Spill, PAC 100-611

An inoperative pump in the Building 123 process waste transfer system caused the Building 123 scrubber system to overflow, spilling scrubbing solution into a bermed area outside of the building and into three pits beneath the floor of the building. Also, approximately 5 gallons of liquid were present in and around a nearby storm water drainage ditch which served the Building 123 parking lot. It was speculated that this liquid leaked from the berm wall interface with the underlying asphalt. However, it was later concluded that this liquid was not associated with the incident (that is, it was in the ditch prior to the incident). All of the spilled solution was contained within secondary containment structures, and none of the solution was believed to have impacted the environment.

Under normal operating conditions, the scrubbing solution drained into the process waste system when the scrubbing process was completed. The source of the problem was waste pump switches that were in the wrong position, as well as the influent valve that was blocked by glass filtering wool from Building 123.

The scrubbing solution consisted primarily of water, which was used to scrub HNO_3 , hydrofluoric acid, and HCl used in Building 123. Approximately 50 gallons were released to the bermed area, and several hundred gallons were contained in the three pits beneath the Building 123 floor. Analyses showed the solution in the bermed area had a pH of 1.6, while the solution in the three pits had a pH of 6.0.

The 5 gallons of liquid in the parking lot drainage ditch did not react when sodium bicarbonate was applied, indicating it was not acidic and, therefore, was not the scrubbing solution.

Normal scrubbing solution drainage was restored when the glass wool material was cleared and the inoperative process waste pump was restarted. A submersible pump was used to transfer the scrubbing solution from the bermed area to process waste drains in Building 123. Measures were proposed to prevent subsequent buildup of glass wool in the process waste system. A RCRA CIPR (89-019) was written.

IHSS GROUP 100-5

Building 121 Security Incinerator IHSS 100-609

A security incinerator located south of Building 121 was used for incineration of classified documents. During some period in its operating history, the incinerator was used to burn no carbon required (NCR)-type paper containing PCBs. It is known that ash from the

incinerator was disposed at the Present Landfill (PAC NW-114) in December 1980. It is not known whether this was standard practice throughout the incinerator's operating history.

According to one source, "tons" of NCR paper, containing up to 10 to 20 percent PCBs, were burned in the incinerator. Dioxins and furans could potentially be generated from incineration of this paper.

In 1985, RFP proposed that two to four smear samples be collected from the incinerator and analyzed at an off-site laboratory for dioxins and furans. A second sampling phase was also proposed if warranted by the results of these samples. It is not known whether the smear samples were collected.

IHSS GROUP 300-1

Oil Burn Pit #1 IHSS 300-128

On August 18, 1956, an experiment was conducted that involved burning contaminated oil from Buildings 444 and 881 in an area referred to as the "garage oil-burning pit." Barrels were dumped on the south side of a pit located north of Building 331 and ignited. At one point rocks were thrown into the oil to agitate the surface to facilitate burning. Reports documenting the incident conflict as to the exact amount that was burned on that day. A Health Physics Report from 1956, which details the incident, indicates that six drums were dumped into the pit (an estimated 200 gallons). Other reports state that 10 drums of waste oil were burned.

Prior to the burning, several high-volume air samplers were started to obtain background data; however, not all the samplers were started at the same time and several were not started for approximately 1 hour after the fire had been initially ignited. The report also documents the refueling and failure of a generator that was powering many of the samplers. One sampler was placed in the path of the "black plume," which was moving at a 30-degree angle and rising to a height of 40 to 100 ft. The plume moved in the general direction of Building 123.

Filters from air samplers monitoring the experiment yielded alpha radiation readings ranging from 0.1 disintegrations per minute per square meter (m^2) (dpm/m^2) to 30 dpm/m^2 . The low reading was taken from the roof of Building 123 and the high reading was taken approximately 60 ft south of the burning pit directly in the smoke plume.

A direct survey was conducted of the soil and oil residue within the pit. Two spots along the south bank of the pit where the oil was dumped had meter readings of 500 and 750 cpm alpha activity. Soil samples were collected but the results are unknown.

After the burning operation, the residue was left in place and the pit was backfilled. It is not known when the backfilling took place. The residues were not removed prior to further construction in the area.

One reference states that Building 225 was constructed over the area impacted by the activity; however, based on the review of aerial photographs, it appears that Sage Avenue and the Sage Avenue Ditch are now over the area.

Lithium Metal Site, IHSS 300-134(N)

Reactive metal disposal was conducted in two locations north of Building 331. The first site coincides with IHSS 134; however, the boundaries were enlarged. Detailed review of aerial photographs indicates that part of the site is now covered by Sage Avenue. The second site is located in the corner formed by the L-shape of Building 331. Part of the roof and adjacent parking lot are included.

Many documents indicate that lithium was burned in this area; however, interviews with RFP Fire Department employees present during these activities contradict this. They indicated that although some small amounts of lithium may have been destroyed at this location, magnesium was the primary constituent of concern. Inspection of EPA aerial photographs reveals the presence of two pond-like structures roughly 250 ft north of Building 331. The westernmost pond measures 30 by 40 ft and the eastern pond is 15 by 20 ft. Documents describing the operations indicate various-size ponds.

The area impacted by these activities lies north of Building 335. The site was originally located in a depression adjacent to the Walnut Creek drainage north of Building 331 and west of Building 553. Aerial photographs clearly indicate construction modifications took place in this area that affected the drainage pattern of Walnut Creek. The construction of Sage Avenue began in the late 1960s and ended in 1970 when paving was completed. It now covers part of PAC 300-134.N. The drainage was also affected by construction of Building 371 in the early 1970s. Building 335 was built over the southern part of the site at approximately the same time.

Photographs taken in 1966 show a white residue coating the depression where the metal destruction took place. Other photos taken from a distance show a dense black cloud coming from this area. It is not known whether the smoke plume was the result of metal destruction or a grass fire, which was often caused by the burning activities.

In addition, it was discovered through an interview with a former RFP employee that graphite was buried nearby. The graphite was discovered during excavation at the intersection of Fourth Street and Sage Avenue. The interviewee was uncertain as to why or when the excavation took place.

Analyses of surface soil samples during the OU 13 Phase I RFI/RI indicated that americium-241 and plutonium-239/240 were detected above background. These data are available in the IA Data Summary Report (DOE 2000a).

Solvent Burning Grounds, IHSS 300-171

Building 335 has been used in the past, and still is to some degree, for training of Fire Department personnel. The original, preconstructed building was placed in an area north of Building 331 after the 1969 fire (PAC 700-150.7). Experiments took place to test heat and water effects on different types of materials (for example, filter plenums). Filter plenum tests were conducted inside the building and provided smoky, cramped, fire fighting experience. One incident of burning was on June 9, 1972, when steel beams were tested in a fire by burning diesel oil in an open pit.

Other types of training included the use of a large cross-shaped pan or a smaller square pan into which diesel fuel was placed and ignited. Most of the fuel was burned during the process although some was allowed to remain in the pan and mix with rainwater. The mixture was then dumped onto the ground. RFETS Clean Water Act Division personnel conducted an inspection on December 11, 1990. The large cross-shaped pan was found to have holes in it and oil-contaminated soil was present around the pans. The contamination was thought to have spread to a nearby catch basin (storm drain) where an oily sheen could be seen on the surface of the standing water. Running water in a nearby ditch had no visible sheen.

The area is still used today for fire fighting training. This type of training is conducted by the use of a "tree" constructed of metal that allows propane to escape from the "branches" of the tree. A large quantity of water is used during this process that is allowed to flow into the storm drain.

At a site visit conducted on November 21, 1991, the cross-shaped pan was present but covered. The water standing in the storm drain (catch basin) still had an oily sheen on the surface. There was no evidence of soil contamination. Building 335 had a visible black residue along the top of the large, east-facing door.

When this area was first used for training purposes, magnesium chips coated with a water-soluble material were burned. Diesel fuel was the main material that was used and gasoline was used to ignite the diesel fuel. The firefighters may have also used waste solvents.

No documentation was found, and interviewees were unaware of any type of soil removal prior to construction of Building 335. No soil or air sampling was conducted to the knowledge of one RFETS Fire Department employee.

Analyses of soil samples during the OU 13 Phase I RFI/RI indicated that calcium, copper, iron, magnesium, sodium, nickel, and strontium were detected above background. These data are available in the IA Data Summary Report (DOE 2000a).

IHSS GROUP 300-2

Maintenance, UBC 331

Information on Building 331 is from the HAER (DOE 1998a). Building 331, originally constructed in 1953, was designed and used as a warehouse. When the building became too small for parts storage, a new warehouse was constructed at another Site location and Building 331 then became the Site maintenance garage. Additions to the structure, including the Fire Department structure, were completed in 1967.

At one time, the northeastern corner of the vehicle maintenance garage housed a technical staff and a uranium research and development laboratory. Rolling of enriched uranium foil was conducted there in 1964. This area may also have been used for the development of depleted uranium coating studies. After Building 865 came on line in 1970, the area was converted for the development of remote handling techniques such as robotics and remote manipulator arms.

Lithium Metal Destruction Site IHSS 300-134(S)

Reactive metal disposal was conducted in two locations north of Building 331. The first site coincides with IHSS 134; however, the boundaries were enlarged. Detailed review of aerial photographs indicated that part of the site is now covered by Sage Avenue. The second site is located in the corner formed by the L-shape of Building 331.

IHSS 134(S) is located adjacent to the north side of Building 331 and includes a portion of the roof and adjacent parking lot. It is in the L-shaped corner of the building and the parking lot to the north where Fire Department personnel indicated lithium destruction took place. Lithium destruction may have also taken place at a location midway between Building 331 and Building 335.

Lithium was originally burned by placing it on the ground and sprinkling it with water. Sometimes magnesium chips or a flammable material such as gasoline were used as initiators. On October 13, 1966, a fireman was injured during lithium destruction activities and the use of this location for disposal of lithium was discontinued. Destruction of lithium in drums at the 331 parking lot is documented as late as 1969. On September 5, 1969, lithium was being dissolved inside a barrel when it exploded. Lithium was dispersed in the area of the 331 parking lot and onto the roof of Building 331. The building has since been reroofed several times. The incident occurred soon after the addition was built onto the eastern end of Building 331.

Exact amounts of lithium that were destroyed in this area are not documented; however, it is known that by 1970, approximately 400 to 500 pounds of metallic lithium were destroyed and the residues were buried. These amounts are thought to be a combination of lithium destruction from this site and from another site in the southeast part of the Plant (PAC 900-140). The waste lithium originated from Building 444 and Building 881 and was not radioactively contaminated.

Other reactive metals such as sodium, calcium, and magnesium, and some solvent-types of chemical compounds were also destroyed in one or both of these sites. Disposal by burning was enhanced with magnesium chips and other flammable items such as gasoline, oily rags, or paper.

An interview was conducted on December 4, 1991, with a former RFP employee. It was stated that during the excavation at the Building 335 intersection, approximately 5 to 6 cubic yards (yds³) of graphite in the form of solids, molds, and fines were uncovered.

Residues resulting from metal destruction were covered. The corners may have been marked, but on a site visit conducted November 11, 1991, none was found. Building 335 was subsequently placed on or near this location, Sage Avenue was constructed over it, and the location was also disturbed by construction of Building 374.

IHSS GROUP 300-3 (IA)

Plutonium Recovery, UBC 371

Building 371 was the Plutonium Recovery Facility and is now the Interim Plutonium Storage/Repackaging Facility. Building 371 went into operation in 1981 with a mission to

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(1) replace plutonium residue recovery and waste operations from Buildings 771 and 774, (2) recover plutonium from weapons returned from the stockpile, and (3) provide storage of plutonium and plutonium-bearing materials. Plutonium recovery operations in Building 371 were terminated in 1981. Since 1989, Building 371 has been used primarily for the storage of plutonium and uranium metals, oxides, residues, transuranic (TRU) wastes, LLW, and RCRA-regulated mixed waste and residues (RMRS 2000c). The remainder of this description is from the HAER (DOE 1998a).

Building 371 originally had two incinerators and their afterburners located in separate concrete canyons that were designed to burn most of the combustible wastes generated by the plutonium recovery operations. One incinerator was for high specific activity waste, and the other for low specific activity waste. Due to the size and shape of the incinerators, they spanned multiple levels of Building 371. These two incinerators were stripped out approximately 10 years ago to make way for the installation of the Plutonium Recovery Operations Verification Exercise gloveboxes and plutonium processing equipment.

Past operations in Building 371 focused on the recovery of plutonium from Plant activities (nuclear weapons parts fabrication, component assembly, and research and development activities). Other operations included material transfer, waste incineration (radioactive wastes were never incinerated in Building 371, only simulated combustible wastes were incinerated), and laboratory support.

Plutonium recovery operations used two different systems to separate high-purity plutonium metal from production-generated wastes. Pyrochemical processing used furnaces and molten salts to separate high-purity plutonium in a dry process. Pyrochemical processing was very efficient, but could not be used with all types of plutonium-bearing materials. Aqueous processing used a series of wet and dry chemical steps to separate high-purity plutonium from production-generated wastes.

Materials entering the plutonium recovery process were received as pieces of impure plutonium metal, plutonium oxide, various compounds containing plutonium, and plutonium-contaminated residues. The plutonium content of these materials ranged from a few percent to almost pure plutonium metal. The recovery processes reduced the plutonium and americium content of the residues to levels below economic discard limits.

Pyrochemical plutonium recovery (or pyrochemical processing) began in 1981 and ceased in 1988. Metal plutonium was processed through a pyrochemical operation in which americium was extracted from the plutonium by direct contact with molten salts, yielding a plutonium button low in americium. If other impurities had to be removed, the extracted metal went to an electro-refining process where the plutonium was transformed by electrolysis in a molten-salt bath to an impure plutonium heel, contaminated salt, and product metal of very high purity. Impure metal was burned, converting it to an oxide, and processed through the aqueous chemical recovery systems. The high-purity plutonium button was transferred to the Building 707 foundry operations for casting and weapon component fabrication.

Contaminated salts were transferred to Building 771 for americium separation and plutonium recovery.

Dicesium hexachloroplutonate (DCHP) preparation took place for the purpose of converting plutonium oxide to reagent salt DCHP. The DCHP was used as the oxidant in the pyrochemical molten salt extraction recovery process in Building 776 for the extraction of americium from site-return metal. DCHP production in Building 371 began in 1989 using nonspecification-grade plutonium oxide as the source of plutonium feed material, and ceased operation in 1990.

The DCHP preparation process involved two major steps: (1) oxide dissolution and (2) precipitation and drying. The oxide dissolution step involved dissolving plutonium oxide in HCl and calcium fluoride. The resulting slurry was then filtered, separating the undissolved solids from the solution. The precipitation dry step mixed the filtrate with cesium chloride in HCl and sodium nitrate to precipitate DCHP, which was the reagent used in the Building 776 plutonium recovery operations. The DCHP was removed from the solution by filtration and dried in an oven, or muffle furnace, before transfer to Building 776 for use and/or to Building 371 for storage.

The process contained a system for treatment of offgases vented from the various reaction vessels. Oxide dissolution filtration off-gas, DCHP filtration offgas, and muffle furnace offgas were all initially routed into a trap flask. The offgases were then passed into a caustic flask where potassium hydroxide was added and the gases were eventually discharged through a vacuum pump and treated in the caustic treatment process. The undissolved plutonium oxide solids from the oxide dissolution step were either recycled through dissolution and/or removed from the glovebox for storage.

Aqueous plutonium recovery used plutonium oxide and other materials as feed material and required a series of wet and dry chemical processing steps to produce a plutonium button of high purity. As a first step, the oxide and other materials were dissolved in HNO_3 in a series of cascade dissolution pots. The plutonium-containing acid solutions from the dissolution processes were adjusted for normality with HNO_3 or water and ferrous sulfamate (for plutonium valence adjustment) into an adjusted HNO_3 feed. The adjusted plutonium nitrate feed solution was then pumped through anion exchange columns. The anion exchange resin selectively absorbed plutonium ions while allowing certain other metallic ions (iron, chrome, nickel, and so forth) to pass through. americium formed a weak bond with the resin, allowing selective segregation of the americium from the plutonium. Solutions high in americium were segregated for further processing in americium recovery, and the remainder went through a secondary recovery process.

The loaded anion exchange resin columns were then washed with HNO_3 to remove the metallic impurities and the product plutonium nitrate solution was collected in clean product eluate tanks. The anion exchange eluate was concentrated in an evaporator. The evaporator concentrate was then fed into a line of precipitation vessels where the plutonium was precipitated as plutonium peroxide. The precipitate was filtered and the filtrate was recycled through anion exchange. The precipitate was transferred to calcining furnaces where the plutonium peroxide was converted to plutonium oxide by heating.

The dry plutonium oxide was pneumatically transported to a fluidized-bed reactor, the direct fluorination process canyon. The plutonium oxide was contacted with a fluorine-argon gas mixture to keep it fluidized while converting it to plutonium tetrafluoride (PuF_4). When the

reaction was complete, the PuF_4 was transported to a receiving vessel in the reduction canyon.

The PuF_4 reduction to plutonium metal was performed in the reduction canyon. Calcium metal was measured into reduction vessels, and the PuF_4 was added. The reduction vessel was sealed in an induction furnace, evacuated, and purged with argon gas to remove the oxygen. The reduction charge was then heated to initiate a reduction reaction that yielded a pure plutonium metal button and calcium fluoride slag. The plutonium button was sampled, stamped, and shipped as product. The calcium fluoride slag was recycled as cascade dissolver feed.

The HNO_3 recovery process consisted of tanks, gloveboxes, an evaporator, and distillation columns that were used to purify the large quantity of HNO_3 used in the metal recovery process. The system experienced significant equipment problems. One of the problems associated with the system was that it overpurified the acid above reagent grade. The pure HNO_3 interfered with proper functioning of equipment in Building 371.

There were four plutonium analytical laboratories in the Building 371/374 Complex to support environmental, safeguards, and other regulatory requirements. They include the liquids laboratory, standards laboratory, analytical laboratory, and liquid waste sampling laboratory. The liquids and analytical laboratories are out of service. Building 371 also housed plutonium analytical laboratories and a chemical standards laboratory, which supported operations throughout the Site. The plutonium analytical laboratories served Buildings 371 and 374 and acted as a backup for the Building 771 analytical laboratory. The majority of the work at this laboratory consisted of total alpha and beta counts along with radiochemical analyses for specific isotopes in liquid and solid samples. These analyses served as a screening process to identify highly radioactive samples that were unsuitable for detailed analyses in Building 881.

The chemical standards laboratory in Building 371 prepared both nondestructive and destructive assay standards for various user groups at the Site, and inspected standards used in the field. Most laboratory operations took place in gloveboxes. Nondestructive assay standards were prepared for plutonium, americium, and uranium oxides and metals (including beryllium) for a wide range of instrumentation.

The Building 371 Caustic Waste Treatment System (CWTS) processed both high- and low-level plutonium solutions from tank and pipe draining operations from Building 371 and Building 771. The CWTS process provides for the collection, sampling, filtration, and disposal of miscellaneous caustic and acidic plutonium-contaminated solutions to waste treatment that meets the Building 374 acceptance of 4.0×10^{-3} grams/liter (g/L) plutonium + uranium-235, and 1.0×10^{-3} g/L americium. The CWTS process provides for the treatment of RCRA-regulated hazardous waste and aqueous waste streams.

The equipment for CWTS is located in the subbasement of Building 371. Processing is performed in gloveboxes and tanks. The CWTS process uses magnesium hydroxide powder to precipitate plutonium, uranium, americium, and other metal impurities. The CWTS process generates three products: (1) the basic filtrate solution, which meets the shipping requirements of caustic waste to Building 374; (2) a low-level dried filter sludge, which is

expected to be discardable with the required approvals; and (3) the product from high-level solutions, IDC 054H, which is high-level dried filter sludge, that requires further processing in PuSPS.

The shipping, receiving, storing, and retrieving of special nuclear material (SNM) occurred daily in Building 371 operations. The receiving and shipping of on- and off-site waste, residue, and SNM occurred from Dock 18T of the Building 371/374 Complex Support Facility. Two additional shipping and receiving docks are in the Support Facility on the southeastern corner. Building 374 has two loading docks supporting operations. SNM is stored in vaults or vault-type rooms in Building 371. The Central Storage Vault (CSV) extends through the subbasement and basement levels of Building 371. The CSV is designed to be ventilated by a nitrogen atmosphere, and accessed by the remotely controlled Stacker-Retriever (S-R). SNM received in liquid form is stored in CWTS tanks in Building 371.

Residue and waste drum maintenance was conducted daily in Building 371. Residues and wastes are stored in many areas throughout Building 371 and the support facility. Repackaging of residues may occur in several areas.

Sand, slag, and crucible (SS&C) repack involved repacking ceramic byproduct residues from plutonium metal production, which were initially stored for the recovery of residual plutonium. These residues resulted from production of plutonium metal buttons and may contain PuF_4 , calcium metal, magnesium oxide crucibles, and/or magnesium oxide sand. The SS&C residues will be shipped off-site for processing. After SS&C repackaging has been completed, the containers of SS&C are transferred to the nondestructive assay room. The SS&C nondestructive assay equipment is part of the repackaging process.

The CSV (and S-R) was used to store and retrieve plutonium metal and solid residues. The S-R moved materials between the shipping and receiving areas, plutonium storage vault, and plutonium recovery processing areas. Current operations in Building 371/174 are described below.

As stated earlier, there are four laboratories in the Building 371/374 Complex to support environmental, safeguards, and other regulatory requirements. They include the liquids laboratory, standards laboratory, analytical laboratory, and liquid waste sampling laboratory. The liquids and analytical laboratories are no longer in use. The Building 371 standards laboratory is operated daily or as chemical standards need to be made and/or verified.

Caustic waste treatment provides for the treatment of miscellaneous caustic and acidic waste solutions containing plutonium. Treatment predominately consists of waste collecting, sampling, precipitating, and filtering waste solutions. The equipment for caustic waste treatment is located in the subbasement of Building 371. Processing is performed in gloveboxes and tanks within these rooms.

Various chemicals are stored and managed throughout the Building 371/374 Complex. Potassium hydroxide (KOH) (6N) is supplied from one 28,500-gallon tank and one 10,400-gallon tank located just north of B371. A 16,000-gallon storage tank in the same area supplies HNO_3 (12N). The KOH and HNO_3 storage tanks share a bermed, compartmentalized area. The chemical makeup area for the facility maintains storage of a

variety of chemicals required for facility operations. In addition, the majority of bottled, compressed gases (for example, propane and argon) are stored on Docks 18T and 5. Liquid nitrogen is stored in a tank immediately north of Dock 18T. Analytical laboratories within the facility maintain chemical inventories to support laboratory operations.

Various aspects of the maintenance, surveillance, and stabilization of SNM may be performed in Building 371. Rooms have downdraft tables for transfer of material, weighing equipment, furnaces, and access to the CSV input/output (I/O). Repackaging activities that do not require a downdraft table can be performed in Zone II rooms. Sealed pits or pressure vessels can be packaged or leak-tested in Zone II or Zone III rooms. SS&C residues are reduced for repackaging and shipment off-site.

Several documented releases of materials to the environment have occurred at Building 371 and include the following:

- Maintenance personnel discovered approximately 55 gallons of waste water on the floor of Room 2217 on August 2, 1989. This incident resulted in the filing of a RCRA CIPR.
- A RCRA inspection of a 90-day accumulation area located in Room 3811 revealed that a metal 55-gallon drum containing dilute sulfuric acid solution had ruptured on December 20, 1989. This incident resulted in the filing of a RCRA CIPR (DOE 1992a).

North Firing Range (BZ), PAC NW-1505

The North Firing Range, including Buildings 303 and 308, is located in the northwestern BZ and has been and remains in use for target practice and security officer qualification. The range consists of a concrete pad covered by a roof. Until 1993, the target area consisted of a bermed area (approximately 300 ft by 200 ft). In December 1993, construction began to enhance the range with an improved backstop (bullet trap), walls, and roof.

Potential lead contamination may have resulted from bullets fired into the northern berm within the firing range. Brass bullet casings have been collected, containerized, and sent to PU&D for recycling since the range began operation in 1983 (Richmond 2001). Several times a year, bullets and lead fragments (collected in the bullet trap) are containerized in 3-gallon plastic buckets and transferred to PU&D for recycling. The use of solvents for cleaning firearms has not occurred at this location, nor have any explosives been detonated or armor-piercing ammunition been used. No solvent spills or releases are known to have occurred at this location. The concrete pad is washed with approximately 200 to 300 gallons of water several times a year. The rinse water flows into a culvert on the eastern side of the pad and has been blocked with sediment and vegetation for an undetermined length of time. Collection of the rinse water from the pad washing has been scheduled for the next washing operation. Further characterization of soil associated with this PAC will be completed after final D&D of the facility.

IHSS GROUP 300-4

Waste Treatment Facility, UBC 374

Information on Building 374 is included in the description of Building 371. Building 374 houses the process waste treatment system and began operation in the 1970s. Several documented releases of materials to the environment have occurred:

- A solution of 40 percent dissolved nitrate salt overflowed Tank D-883-B in Room 3809 on June 15, 1989, and ran into the process waste floor drains.
- Process solution filled a glovebox in Room 3801, pushed out a window of the box, and approximately 50 gallons spilled onto the floor on November 23, 1989.
- Approximately 100 gallons of process waste solution leaked from a pump in Room 3810 and drained through a process floor drain on November 29, 1989.
- Approximately 500 gallons of a hydroxide salt solution (pH 12.6) leaked from a tank in Room 4101; some ran through cracks in the concrete floor to a hallway beneath the room.
- Operator error led to a spill of brine concentrate in Room 3809; the spill was rinsed down the process drains.
- Due to an inoperative floor drain, 150 gallons of brine concentrate spilled onto the floor of Room 3810 (DOE 1992a).

IHSS GROUP 300-5

Inactive D-836 Hazardous Waste Tank IHSS 300-206

Tank D-836 was a 19,000-gallon, carbon-steel tank used for hazardous waste storage. The tank had no secondary containment and was located on compacted soil. This was a 90-day storage tank situated at the northwestern corner of Building 371 near Door 5. Specifications for Tank D-836 can be found in the RCRA 3004(u) document.

A spill of condensate water occurred on February 18, 1980, when a line from the evaporator to the tank was disconnected. The tank was used to hold off-specification Building 374 product water (that is, water too high in conductivity). The spill contained low concentrations of tritium.

IHSS GROUP 300-6

Pesticide Shed, PAC 300-702

Building 367 was used to store pesticides and herbicides since 1952 when the first spill is assumed to have occurred. In 1988, large quantities were being stored there and the building showed signs of spills and leakage. There were no spill containment features; therefore, release of contamination to a nearby drainage ditch may have been possible.

Large quantities of pesticides and herbicides were stored and mixed in Building 367 from 1952 to 1988. Equipment and containers were cleaned and the rinsate water was dumped

onto the ground outside the building. In 1988, the unused chemicals were disposed in an unknown location and the area around the building was cleaned up.

IHSS GROUP 400-1

Radiological Survey, UBC 43

Current information on Building 439 is from WSRIC (RMRS 2000d). Building 439 was previously a maintenance building, but is currently used for PU&D operations. Building 439 is used to receive, process, and ship surplus equipment and materials released by Plant custodians. Building 439 houses small portable counters that monitor alpha, beta, and gamma radiation. Sources are controlled through the Site accountability procedures. Smear samples collected throughout RFETS are brought to Building 439 for counting.

IHSS GROUP 400-2

Modification Center, UBC 440

Information on Building 440 is from the HAER (DOE 1998a) and WSRIC (RMRS 2000e). Building 440 was constructed in the late 1960s for production control and shipping final assembly products and disposal wastes. SNM and depleted uranium were staged and shipped out of this building by truck and railcar. For a brief period, Building 440 was used as a general warehouse and storage area for non-nuclear construction and fabrication materials.

In the early 1970s, Building 440 was used to modify and repair vehicles to meet specific U.S. Department of Energy (DOE) requirements for transport of SNM and radioactive wastes. Building 440 was expanded three times to include a railcar bay, high bay, paint booths, storage areas, and locker rooms in support of transport modification efforts. Armor, communication equipment, and comfort features were added to transport vehicles. Vehicle modification work in Building 440 continued until 1994, when the mission was transferred to another DOE facility. Most of the original equipment associated with this activity has been shipped to other DOE plants.

Production processes in Building 440 included various welding, painting, machining, pipefitting, metalworking, and electrical work used to modify transports. Modification efforts focused on developing entry deterrents. Paint booths were used to coat fabricated, non-nuclear components and the transports. The gantry and 5-ton cranes were used to move materials associated with the transport modification effort.

IHSS GROUP 400-3

Fabrication Facility, UBC 444

Information on Building 444 is from the HAER (DOE 1998a) and HRR (DOE 1992a). Originally called Plant A, Building 444 was one of the first buildings constructed at the Plant. Building 444 was the primary non-nuclear manufacturing facility at the Site. Manufacturing processes were used to fabricate weapons components and assemblies from a variety of materials, including depleted uranium, beryllium, stainless-steel, aluminum, and vanadium.

The production equipment located in Building 444 was used to support war reserve, special orders work, and manufacturing development. Operations included casting, machining, heat treating, welding, brazing, chemical milling, plating, coating, and testing and inspection of weapons components made of depleted uranium, depleted uranium composites, beryllium, stainless-steel, and ferric metals. Each material required different processing techniques.

When expansion of the Site took place in 1956 and 1957, additions were made to Building 444. The expansion was motivated by changes in trigger design and subsequent increased fabrication requirements.

The original building area contains a foundry and numerous shops and laboratories. Shops within the original portion of the building include depleted uranium, beryllium, and carbon (graphite) machine shops; and heat treating, coating, tool grinding, welding and brazing, and building maintenance shops. A portion of the precision shop is also housed in this building. Laboratories include pressure- and leak-testing, plating, precision measuring, and non-destructive testing laboratories. Some of the former shop areas were converted into storage areas for excess tools and materials.

A May 1960 vacuum collector fire in Building 447 and a December 1962 U/beryllium release from Building 444 have impacted much of the 400 Area.

Fabrication Facility, UBC 447

Building 447 is part of the 444 Complex and was a depleted uranium fabrication facility. Ingots and semifinished and finished depleted uranium parts were heat treated in the induction furnace. In 1956, the chip roaster in Building 447 became operational. Depleted uranium chips recovered from machining areas were collected in covered 55-gallon drums, transferred to Building 447, and burned to an oxide (a more stable form) under controlled conditions in the chip roaster. The oxides were packaged and shipped off site for disposal.

West Loading Dock Building 447, IHSS 400-116.1

The west loading dock, IHSS 116.1, is a staging and storage area associated with Building 447. The west loading dock has been in operation since 1956, and is located on the northern side of Building 447, west of Building 444. Beryllium component manufacturing operations began in approximately 1958. Major processes conducted in the building included machining, welding, and cleaning. There was also a foundry and a laboratory in which parts were etched, electroplated, and coated.

Building 447 was put into service in 1956 and housed both assembly-related processes and waste-related processes. In Building 447, metal parts from Buildings 444 and 460 were cleaned, leak-tested, welded, and heat-treated. The heat treatment process was designed to relieve stress and machining damage in the parts. A chip roaster was operated at one time to convert depleted uranium chips from Building 444 to uranium oxide.

Drums containing nonradioactive solvents may have been stored on the dock. Dark stained soil from spills and leaks of oil stored in drums near Building 453 is located immediately north of the loading dock.

A radiometric survey was performed in the vicinity of the west loading dock as part of a sitewide survey in April and May 1984. Areas south and west of Building 477 and areas north of Building 453 were identified as areas that could not be surveyed for plutonium because of high-level background radioactivity.

IHSS 116.1 is primarily surfaced with asphaltic concrete. Two areas of exposed soil flank the eastern and western sides of the driveway leading to the dock. The exposed soil on the western side is poorly covered with an asphalt-type substance, but this cover is not considered adequate to prevent material migration into the soil. The driveway leading to the dock is sloped toward the dock. The eastern exposed area slopes slightly toward the west, and the western exposed area slopes toward the east at approximately 45 degrees. Because of this topography, two drains provide drainage for the loading area: one on the eastern side, and one on the western side of the driveway. The IHSS boundary also includes a small area of the tarmac at the top of the west slope, directly north of Building 457. This area includes a catch basin that provides drainage for the area.

HPGe survey data collected during the OU 12 Phase I RFI/RI at the IHSS 116.1 area indicate elevated activities of uranium-235 and uranium-238. Three sediment samples were collected from IHSS 116.1. Gross beta and uranium-238 exceeded background levels at one location. Chromium and zinc also exceeded background. Eight soil gas locations were sampled at IHSS 116.1. Ethylbenzene and total xylenes were detected in the southeastern corner of the IHSS at concentrations of 1.050 and 5.0 µg/L, respectively. Total xylenes were detected in the southwestern corner of the IHSS at a concentration of 4.95 µg/L. Methane was detected at three locations, with results ranging from 50 to 120 ppm. These data are available in the IA Data Summary Report (DOE 2000a).

Cooling Tower Pond West of Building 444, IHSS 400-136.1

Although reference to three cooling water ponds in the vicinity of Building 444 was made in the CEARP Phase I report (DOE 1986), documentation examined during the HRR search supported the existence of only two ponds (DOE 1992a). The pond located west and north of Building 447 (IHSS 136.1) can be clearly seen in an aerial photograph taken in 1965 (DOE 1992a). It is located north and west of the location described in the IAG as IHSS 136.3. The former pond location is now partially or completely covered by Building 460, aboveground tanks, and pavement.

IHSS 136.1 is an area where a cooling water impoundment was located. The IHSS is located east of Building 460 and west of IHSS 116.1. The entire IHSS is paved with asphaltic concrete and is partially covered by Building 460. A single catch basin is located in the southwestern corner of the IHSS.

HPGe surveys conducted during the OU 12 Phase I RFI/RI indicate elevated activities of uranium-238 (8.3 ± 0.34 pCi/g) and uranium-235 (0.15 ± 0.02 pCi/g). Surface soil samples collected from IHSS 136.1 indicated radium-228, uranium-238, americium-241, radium-226, and zinc above background. Four soil gas locations were sampled at IHSS 136.1. TCE was detected at 98.0 µg/L, PCE was detected at 3.8 µg/L, and methane was detected at concentrations of 10(J) and 20 ppm.

Cooling Tower Pond East of Building 444, IHSS 400-136.2

Every document found addressing the location of cooling tower ponds in the 400 Area describes this pond as being “due east of Building 444” or “east of the Building 444 exclusion fence,” which is assumed to be IHSS 136.2. The pond was reportedly used on May 25, 26, and 27, 1956, by an outside contractor (Dowell) to collect various solutions used during cleaning of the Building 444 cooling tower. Typical solutions used to clean cooling towers at the time were acidic or contained chromate. In September 1956, when the liquid had evaporated and percolated away, the pond was backfilled. On December 2, 1958, cooling water from Building 447 was reportedly pumped to a surface ditch and allowed to flow across Plant site (PAC No. 000-501). Before 1958, drainage and flushing of the cooling water was diverted to the cooling tower blowdown pond east of Building 444, not to a surface ditch, making the 1958 documentation unclear. The several references to a pond east of Building 444 may have been referring to the pond used by Dowell in 1956, or to other standing water observed in the same relative location in later photographs.

The exact location of IHSS 136.2 is unclear based on maps and text in the HRR. However, the location of standing water in later photographs best fits the description of the pond used during the Dowell operation, and it is also close to the cooling tower that is immediately east of Building 444. The probable use of this general area as a cooling tower blowdown pond is substantiated by interviews conducted during the HRR with a retired Rocky Flats employee. Another interview conducted during the HRR indicated oil sheen was visible on the surface of the pond.

This IHSS is located in the northeastern corner, and just east of the fence line, of the 400 Area. The entire IHSS is unpaved. A drainage ditch for the 400 Area currently runs through the IHSS and trends north-south. Drainage flow is to the north in this ditch. A rail spur is located east of the IHSS.

HPGe survey data collected during the OU 12 Phase I RFI/RI indicated elevated americium-241, uranium-238, and plutonium-239 activities. Surface soil samples indicated americium-241, cesium-137, plutonium-239/240, uranium-233/234, uranium-238, beryllium, chromium, copper, and zinc above background levels. Americium-241, plutonium-239/240, and uranium-238 exceeded background in sediment samples. Additionally, gross beta levels were above background levels in sediment samples. These data are available in the IA Data Summary Report (DOE 2000a).

Buildings 444/453 Drum Storage, IHSS 400-182

IHSS 182 is located between Buildings 444 and 453 and covers an area of approximately 1,700 ft². The area is currently roped off and is generally empty, although trash, such as wood, is sometimes temporarily placed there. There are no berms around the area.

IHSS 182 was first used as a drum storage area. In May 1957, it was noted that numerous drums of depleted uranium oxide were being stored in the “backyard” of Building 444. Originally, 55-gallon drums were placed directly on the ground. In the mid-1970s, the top 4 inches of soil in a portion of the Drum Storage Area was removed because of potential contamination. The soil was replaced with 4 inches of asphalt. However, drums were still stored on exposed soil in the remaining portion of the Drum Storage Area. It is not known

where the contaminated soil was moved or stored, or whether contaminated soil samples were collected and analyzed.

The maximum number of drums stored at one time was approximately 200. Some of these drums contained unused oil, waste hydraulic oils, and chlorinated solvents. The exact number of drums containing contaminated waste oils or solvents is unknown, although the total container storage capacity at any given time was 11,000 gallons (DOE 1992a). Beryllium and low-level uranium contamination were sometimes present in the waste. Other sources of contamination near IHSS 182 include Building 453, a former oil storage area, and the Building 334 cargo container (DOE 1992a).

Soil investigations in 1988 indicated the presence of acetone; 1,1,1-trichloroethane (TCA); toluene; ethylbenzene; total xylenes; naphthalene; phenanthrene; fluoranthene; and pyrene. Samples were collected from 1-ft-deep excavations below a concrete sidewalk. A 1988 FIDLER survey found readings above background on the asphalt areas and in areas along the buildings and cracks between the concrete and asphalt (DOE 1992a).

Inactive Building 444 Acid Dumpster, IHSS 400-207

IHSS 207 is the former site of Building 444 acid dumpsters which were located east of Building 444. Five-hundred-gallon dumpsters receiving waste were placed in an asphalt bermed area. From 1980 through 1987, the dumpsters were used to store acidic wastes from Building 444. No previous investigations were performed at this IHSS, and no spills were reported.

Inactive Buildings 444/447 Waste Storage Site IHSS 400-208

IHSS 208 is an inactive waste storage area that was previously identified in the RCRA permit application as Unit #3. The storage area was located near Buildings 444 and 453 in the same vicinity as IHSS 182, and consisted of a 20- by 8-ft cargo container with a maximum waste volume of 990 gallons (DOE 1992a).

IHSS 208 was used from 1986 to 1987. Typical stored waste included a composite of HNO_3 with silver, sodium fluoride, sodium fluoride solution, plating acids (hydrochloric acid, HNO_3 , and hydrofluoric acid) with concentrated chromium plating solution, concentrated cadmium cyanide solution, nickel sulfamate, and developer and fixer (DOE 1992b). The storage area had secondary containment. No leaks or spills were reported in the area.

Analyses of surface soil samples collected during the OU 10 Phase I RFI/RI indicated that americium-241, copper, and zinc were detected above background. These data are available in the IA Data Summary Report (DOE 2000a).

Transformer, Roof of Building 447, PAC 400-801

A transformer was located on the roof of Building 447. The pad may have had a berm around it at one time. It is believed to have leaked prior to its removal in 1987. Downspouts are located north of the transformer's former position, which would have allowed PCB-contaminated runoff to infiltrate soil adjacent to Building 447. A storm drain is situated roughly 20 ft from the building and may have also been contaminated.

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Smear samples collected in 1987 from the drain valve and adjacent transformer wall revealed 120 and 194 micrograms of PCBs, respectively.

In 1976, roofing material was removed from under the transformer due to possible leaks. The transformer itself was removed in 1987.

Beryllium Fire - Building 444 PAC 400-810

In February 1977, while welding on a small inlet duct of the beryllium air plenum that serves Building 444, an S&W employee noticed a fire on the face of the prefilters. He immediately informed another S&W employee who activated a manual fire alarm. The Fire Department was already responding to the automatic filter alarm. In approximately 15 minutes, the fire was extinguished.

The exhaust fan automatically shut down when the filter fire detection equipment was activated, resulting in a negative pressure inside the building, causing smoke to back into Room 107. A worker in the area noticed the smoke and activated a third alarm.

Analytical results indicated that 14.5 grams of beryllium were released. This was the only EPA standard that was violated (the EPA limit is 10 grams). Beryllium levels in the fire water collected from the east and south impoundment were 1.6 and 4.3 mg/L, respectively. Analytical results from pond samples and the shower water impounded at Building 990 all indicated concentrations of beryllium less than 0.5 mg/L.

Air sampling stations indicated beryllium concentrations ranging from 0.009 to 0.021 microgram meter per cubic meter ($\mu\text{gm}/\text{m}^3$). At the time of this incident, the Occupational Safety and Health Administration's (OSHA's) standard for an 8-hour time-weighted average was $2.0 \mu\text{gm}/\text{m}^3$. Samples collected along Highway 93 contained concentrations of 0.006 to $0.015 \mu\text{gm}/\text{m}^3$, which can be compared to the EPA standard of $0.01 \mu\text{gm}/\text{m}^3$ for continuous exposure to the general public. RFP Environmental Sciences estimated that exposure time would have been only 0.5 hour.

Stack emission was monitored for uranium during the fire. Total long-lived alpha was found to be 0.08 pCi/L and total uranium was 0.092 pCi/L. Total plant stack emissions for February 1977 were 2.3 microcuries (μCi).

Firemen responded to the fire by initially spraying the outside of the plenum where the paint had blistered. One team was able to extinguish the fire from inside the plenum. A fog nozzle was used which was thought to have "washed" any airborne particulate from the air. Other areas around Building 444 were also sprayed down to control contamination.

Fire water samples were collected from the impounded ditches south and east of Building 444. Water samples were also collected at Ponds A-3, B-3, and C-1, and from the Building 881 shower water where some employees were bussed to take showers. Air samplers were set up to establish the amount of airborne contamination. The roadway south of Building 444, where the fire water flowed, was vacuumed and monitored for beryllium. All smears were determined to have background levels.

Tank 4 - OPWL Process Waste Pits IHSS 000-121

Existing data for this site have not been located.

Tank 5 - OPWL Process Waste Tanks IHSS 000-121

Existing data for this site have not been located.

Tank 6 - OPWL Process Waste Floor Sump and Foundation Drain Floor, IHSS 000-121

Existing data for this site have not been located.

South Loading Dock Building 444 IHSS 400-116.2

The south loading dock started operation in 1953 and is located on the south side of Building 444. The incidents that may have contributed to possible contamination in the south loading dock area are described in the following paragraphs (DOE 1992a).

In 1953, high winds blew the lids off drums stored in this area and potentially released uranium onto the dock, sidewalks, and driveways.

On August 30, 1954, the motor of a portable vacuum malfunctioned while it was being used to vacuum a centrifuge. When the chips in the vacuum receptacle ignited, the receptacle was taken to the dock (known then as Dock No. 2). To extinguish the fire, the bag's contents were transferred to a steel drum and Metal-X powder was added. The explosive nature of the burning material potentially released airborne uranium contamination to the outside atmosphere and covered the dock and adjacent areaway with uranium oxide. This areaway is the pit entrance to the basement that is used to store cyanide and graphite storage drums. After the vacuum incident, the dock was cleaned. However, there is no record that the pit inside the areaway was decontaminated.

Drums containing Perclene (a solvent containing PCE) still bottoms and HNO_3 were stored on the south dock. In October 1955, one 55-gallon drum leaked and sprayed its contents onto two workers who were in the areaway adjacent to the dock. However, the leaks were plugged and the drum was moved. The contents of the drum were transferred to a stainless-steel drum and treated with caustic. Removal of soil in this area was being considered in 1975, but it is not known whether soil was removed.

Until 1970, chlorinated hydrocarbon solvents used to rinse beryllium parts were typically disposed on the ground outside Room 106, which opens to the south dock. Analytical results of soil samples collected at 2 to 4 inches bgs revealed 350 to 1,000 micrograms per gram ($\mu\text{g/g}$) of beryllium from this beryllium-contaminated solvent disposal. Beryllium concentrations are 0.01 to 2 $\mu\text{g/g}$. Personnel conducted air sampling in the area of solvent dumping from June through September 1977. The average concentration of beryllium in air was 0.0009 microgram per cubic meter ($\mu\text{g/m}^3$), which was 9 percent of the EPA air quality standard. Soil removal was not deemed necessary.

Constituents that may have contaminated surfaces around the south dock include enriched and depleted uranium, beryllium, and chlorinated solvents. Direct uranium activity read as high as 7,500 dpm/100 cm^2 , and smear readings with a minimum of 350 dpm were detected around the south dock. Following the 1954 release, the dock and sidewalks were cleaned and the driveway was coated. Air count results during the vacuum fire-extinguishing operations

were as high as 33,000 percent of the maximum permissible limit (MPL) for airborne radioactivity. Direct counts in the dock area were as high as 1,372 dpm.

IHSS 116.2 encompasses the south loading dock for Building 444. The entire IHSS is paved with asphaltic concrete and concrete. Drainage for the area appears to be toward the southeast where material would flow into the drainage ditch that flows east out of the 400 Area.

Surface soil samples collected during the OU 12 Phase I RFI/RI indicated gross beta, radium-228, uranium-233/234, and uranium-235 were above background. Benzene, ethylbenzene, methane, toluene, and total xylenes were detected in soil gas samples. These data are available in the IA Data Summary Report (DOE 2000a).

IHSS GROUP 400-4

Miscellaneous Dumping, Building 460 Storm Drain PAC 400-803

A contractor working on the roof of Building 444 was found dumping miscellaneous materials into the storm drain immediately west of Building 446. The mixture flowed along the open ditch south of Cottonwood Avenue to a point south of the fuel oil storage tanks where it passed beneath the street and ran northeast to the extent of Seventh Avenue. The dumping consisted of silver paint and possibly other materials including oil and aluminum paint.

Road North of Building 460, PAC 400-804

On June 11, 1957, a pallet box with four ingots of unknown composition fell from a truck. The road, which was north of Building 446, was damaged. After removal of the ingots, the area was dry-vacuumed but monitoring was discontinued because of rain. The day after the incident direct counts up to 500 cpm and smears up to 104 dpm were obtained from the damaged area. These hot spots were covered with asphalt patching material.

IHSS GROUP 400-5

Sump #3 Acid Site (Southeast of Building 460), IHSS 400-205

IHSS 205 is located at the southeastern corner of Building 460 at the acid solvent dumpsters. These dumpsters were operated as interim status units during 1986 and 1987 and later used as a 90-day accumulation area.

The dumpsters were constructed with 3/16-inch-thick stainless-steel walls and have a storage capacity of 250 gallons each. Lines ran from the waste generators to a sump or holding tank, then from the sump or holding tank through the concrete wall to the dumpsters, where they were attached by quick-connect couplings. Each dumpster contained an 18-inch-diameter manhole on the top and a 1-inch-diameter drain fitted with a ball valve in the bottom. The paired dumpsters were used so that one dumpster can receive waste while the other is being emptied.

A level sensor was mounted in a 2-1/2-inch-diameter, stainless-steel pipe near the end of each dumpster. An up-to-the-minute log of the volume in the tank was maintained and

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visually checked with the sensor on a weekly basis to determine when dumpster changeover was necessary.

The dumpsters are contained within a concrete bermed area with a concrete divider. Each bermed area measures 4 ft, 6.5 inches wide by 8.5 ft long, and 12 inches deep. Each bermed area has a 286-gallon capacity. The containment areas cannot be drained into one another, but can be partially drained to the area outside of containment through a drain hole located 1-1/2 inches above the basin floor.

Waste materials handled by the acid dumpster were a mixture of approximately 80 percent water and 20 percent acid. The acids were primarily HNO_3 and nitrad, a combination of hydrofluoric acid and ammonium salts.

During an OU 10 Phase I RFI/RI inspection, it was observed that the tanks were disconnected, taken out of service, and triple-rinsed. Documentation of triple rinsing was found on tags attached to the tanks.

RCRA Tank Leak in Building 460 PAC 400-813

During a routine daily inspection in January 1994, approximately 2 gallons of liquid were found in the secondary containment piping associated with a RCRA-regulated process aqueous waste collection tank (RCRA Unit 40.12) in Building 460. The release originated from the gravity drain piping between a process sink and sump tank ST-2 (the ancillary equipment associated with the RCRA unit). The affected piping is located under the concrete floor in Room 151 in the approximate center of Building 460. The secondary containment system for the affected area consists of a pipe within a pipe. The released liquid was determined to contain levels of cadmium and silver that make the material a characteristic hazardous waste.

An engineering evaluation of the integrity of the secondary containment system was conducted to determine whether there was a pathway for contaminants to spread to the environment. Based on the results of the preliminary testing conducted on January 17, 1994, it was determined that there was a possibility that some of the waste was released to the environment underneath the floor of Building 460. Further evaluation on February 1 and 9, 1994, identified a breach in the secondary containment approximately 2.5 ft from the end of the pipe. The breach was approximately 1/4-inch by 1/2-inch in area and was located in the vicinity of a sleeve that joined two sections of pipe. The released liquid contained levels of cadmium (19 ppm) and silver (13 ppm) that classify the material as a characteristic hazardous waste.

The RCRA Contingency Plan was implemented and the liquid in the secondary containment was removed and placed into the process waste system on January 12, 1994. An engineering evaluation was conducted to identify the leaks in primary and secondary containment. The piping was taken out of service on January 12, and a decision was made not to repair the piping until further evaluation was completed. The pipes were temporarily capped to prevent inadvertent use of the system and alternate means of collection were used for the processes that rely on the capped lines. Waste was then collected in drums with secondary containment and the waste was transferred to the Building 460 hazardous waste collection system for disposition.

The contaminated soil beneath the building was not initially removed or sampled for several reasons including the following:

- Inaccessibility of soil removal without core drilling the floor;
- The small quantity (2 gallons) of material released to secondary containment;
- The low level of contaminants in the released hazardous waste (19 ppm cadmium and 13 ppm silver);
- The size of the breach in the secondary containment piping (1/4-inch x 1/2-inch);
- The location of the piping (13.7 ft above groundwater and beneath concrete); and
- No record of previous releases.

RCRA Tank Leak in Building 460 PAC 400-815

On June 29, 1994, a maintenance person discovered a release of approximately 1,800 gallons of process waste water into the secondary containment pit of Sump Tank ST-5 (RCRA Unit 40.15) located in Room 140 of Building 460. Initial surveillance indicated that the Hypalon liner in the pit leaked, filling the associated leak-detection sight tube three-quarters full of hazardous process waste water. In addition, approximately 0.5 to 0.75 inch of water was present in the surrounding bermed area. No leakage had been observed during the RCRA custodian's inspection on the previous day.

Sump Tank ST-5 collects Building 460 process waste water that is initially collected in Tank T-3 and then pumped to a roll filter table that filters the process waste water prior to its collection in Sump Tank ST-5. Sump Tank ST-5 water is then pumped to collection Tank T-1. These tanks, as well as collection Tank T-2, are all contained within a concrete bermed area. The concrete is coated with epoxy with the exception of Pit #5 surrounding Sump Tank ST-5, which is lined with a two-ply continuous 0.036-millimeter-thick Hypalon liner with glued seams. The sight tube associated with this pit is a 12-inch-diameter piece of plastic pipe. It is located in the northwestern corner of the pit and is slightly offset from the concrete floor to allow collection of any liquid beneath the liner and serve as a leak detection device for a breach of secondary containment.

Initially, the released material was believed to be nonhazardous based on process knowledge and analytical information on the cleaning processes. However, based on analytical sample results, it was later determined that the spilled material was hazardous waste. Samples of the waste water inside and outside the pit liner were collected at 5:00 p.m. on June 29, 1994. Additional samples were collected from the roll filter tank and Tank T-3 the following morning.

Preliminary sample results indicated that cadmium levels were likely present above RCRA regulatory levels for toxicity. The validated analytical data confirmed that cadmium exceeded the Toxicity Characteristic Leaching Procedure (TCLP) limit for toxicity in both the pit and the sight tube. Based on the analytical data, no other RCRA metals exceeded

TCLP limits or exhibited the characteristic of corrosivity. The source of the cadmium is believed to be from residual nondestructive testing film developer process waste, which was last placed into the process waste system on June 28, 1994. The developer waste water drains to the tank in Pit #2. Because Sump Tank ST-2 pumping is automatic, it is unknown when the solution from this tank was transferred to Tank T-3.

The maintenance person who observed the leak notified a Building 460 RCRA custodian who in turn notified the 400 Area Shift Manager. The RCRA Contingency Plan was implemented as a precautionary measure, because of the possibility of a release of hazardous waste from a secondary containment to the soil beneath the building. Measurements of the pit were taken that indicated the total quantity released was approximately 1,800 gallons.

In response to the spill, cessation of all process waste activities in Building 460 occurred by 4:00 p.m. on June 29, 1994, approximately 1 hour after the leak was detected. Building 460 Maintenance personnel pumped the tank, pit, and bermed area of as much water as possible and then vacuumed the remaining waste. This water was collected in RCRA collection Tanks T-1 and T-2 in Building 460. The final removal of all liquid from beneath the liner was completed by noon on June 30, 1994.

On June 30, 1994, Maintenance personnel tested the Hypalon liner in the pit for leakage. Three small areas in the liner indicated leakage paths. The liner was also visually inspected and two additional small areas were found near the top of the pit where the liner had separated.

IHSS GROUP 400-6

Radioactive Site South Area, IHSS 400-157.2

The Radioactive Site South Area (IHSS 157.2) includes the soil and paved area surrounding Buildings 444, 447, 440, and 439. Before 1973, soil in the vicinity was reported to contain low levels of uranium and chemical contamination. Buildings 439 and 440 also had possible infiltration of hydraulic oil and carbon tetrachloride originating from the machine tool storage area. A uranium machine tool storage area was in the present location of Building 460. The western boundary of IHSS 157.2 was extended west (DOE 1992a) from what was presented in the IAG (DOE et al. 1991) to encompass the former uranium machine tool storage area, south to include the northern portions of Buildings 440 and 439, and east in an arc that follows the railroad spur. The extension of the boundaries was intended to include other activities that took place in the general area from 1953 through 1990 within this site.

Several operations associated with Building 444 may have contributed to potential contamination in the area. Probably the most significant event occurred near the south dock (IHSS 116.2) where solvents, used to rinse beryllium parts, were disposed on the ground.

Soil sampling conducted twice in 1954 indicated radioactivity levels two and three times that of background activities in a ditch south of Building 444 (DOE 1992a). Neither the sampling locations nor radioactivity results were documented in the HRR.

An ingot open storage area east of Building 444, a metal storage area south of the building, and a uranium machine tool storage area to the west may have contributed to low-level soil

contamination. There have also been cooling tower ponds in the area, described under IHSSs 136.1 and 136.2. Numerous incidents are mentioned in documents found during the HRR search that indicated potential contaminant releases to the IHSS 157.2 area; however, most of them provide few details. The reported incidents are discussed below.

In May 1960, a vacuum collector fire in Building 447 resulted in the release of approximately 44 μCi of depleted uranium. The depleted uranium was deposited on the roof of the building.

In December 1962, a uranium and beryllium release from Building 444 occurred through an unfiltered hood that vented to the exterior of the building.

In June 1966, a process waste line broke north of Building 444.

On November 11, 1974, approximately 170 ft^2 of road south of Building 444 (probably Cedar Avenue) was contaminated when a barrel containing uranium chips was dropped during transfer.

Low-level oblique photographs taken in 1965 indicate drum storage west of Building 555 in a location now covered by Building 460 (DOE 1992a). Similar photographs taken in 1969 indicate a drum storage area at the southeast corner of Building 444 (DOE 1992a). The contents of these drums are not known; however, drums containing cyanide and graphite were known to be stored downstairs through an areaway adjacent to the south loading dock.

Near the southeast corner of Building 444, very close to the railroad tracks, a small building can be seen in the 1969 Rocky Flats photographs. The ground around this building is covered with a white substance related to sandblasting operations (PAC 400-807). Also, just west of Building 445 in the ditch near the railroad tracks, there was a pool of water that may have been the cooling water pond identified in the HRR as IHSS 136.2 (DOE 1992a).

Rocky Flats photographs taken in 1978 show poor housekeeping in the area of Building 440. The area is littered with miscellaneous materials such as pallets, open paint cans, and machinery. There are also cargo containers located north of the building (DOE 1992a).

On February 23, 1978, a fire in the air plenum south of Building 444, which services the beryllium machining operations in Room 107, resulted in the release of an estimated 14.5 grams of beryllium. There was a large cleanup attempt after the Building 444 plenum fire. Firemen responding to the alarm began spraying the exterior of the plenum with water where the paint had started to blister and around the plenum to settle the contaminated dust. Temporary dams were established in the ditches south and east of the building, and samples were collected of the impounded fire water. Laboratory analysis revealed 1.6 mg/L beryllium in the east ditch and 4.3 mg/L in the south ditch. This water was sent to Building 774 for processing. Personnel in the building at the time of the fire were sent to Building 881 for showers. The shower water was retained until analytical results indicated that there was no beryllium present.

An incident occurred on November 4, 1985, involving pressurization of a process line in Building 447. The pressure forced liquid through a floor drain and up the vent pipe onto the

roof, where it ran into the gutter and onto the ground below. The location of the vent pipe was in Room 502, although the specific area of the release on the ground was not provided in the incident report. Documented radioactive contamination levels were as high as 10,000 cpm beta activity. The area affected by the process waste overflow was decontaminated to below 250 cpm or painted to contain the radioactivity. The drain involved was to have been relocated and have a ball check valve installed on the vent pipe.

While three drums were being transferred across the Site on November 30, 1990, one drum containing beryllium ingots was discovered to be radioactive. All areas were smeared along the path the barrels had taken, and high smears (more than 25 counts per minute per square foot [cpm/ft²]) were found just outside the Building 444 beryllium machine shop at the exit/entrance door. The path of the drums is not documented in the HRR.

Little documentation has been found that specifically indicates cleanup of these incidents, except where noted. IHSS 157.2 covers the entire secured area of the 400 Area. Drainage for this IHSS is by overland flow and storm sewers located generally to the south and east.

HPGe surveys conducted during the OU 12 Phase I RFI/RI indicated americium-241 and uranium-238 were elevated in several locations within IHSS 157.2. Subsurface soil samples indicated that americium-241 and uranium-235 were elevated in the northeastern corner of the IHSS. Sediment samples indicated elevated levels of cesium-137, gross alpha, gross beta, plutonium-239/240, radium-226, uranium-233/234, uranium-238, uranium-235, beryllium, calcium, chromium, copper, magnesium, nickel, silver, and zinc. Total xylenes, ethylbenzene, benzene, toluene, and PCE were detected in soil gas samples at IHSS 157.2. Pesticides and VOCs were not detected at concentrations above reference levels. These data are available in the IA Data Summary Report (DOE 2000a).

IHSS GROUP 400-7

Filter Test Facility, UBC 442

Information on Building 442 is from the HAER (DOE 1998a) and HRR (DOE 1992a). Building 442 was originally used to launder uranium-contaminated protective clothing from Building 444. When Building 442 operations changed to filter testing, laundry operations were moved to Building 778.

The final use of the structure included a filter-testing laboratory and storage area for high-efficiency particulate air (HEPA) filters and respirator cartridges. The filter-testing laboratory performed tests on both respirator and equipment-mounted HEPA filters. Radioactive sources were used in some of the test equipment.

Both radioactive and chemical materials including uranium, beryllium, and enriched uranium from the laundry operations potentially affected the soil beneath the building. The soil in the vicinity of this building has also been affected by instances of radioactive release. In December 1963, rag-cleaning barrels leaked or spilled. Liquid drained into the ditch on the northwestern side of the building. In 1964, radioactively contaminated clothing from Building 883 infiltrated the laundry.

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Radioactive Site North Area IHSS 400-157.1

Building 442 was used as a laundry facility to clean contaminated clothing from 1953 until approximately 1972 when it was converted to a filter-testing laboratory. As early as September 1953, contamination associated with the handling and steaming of contaminated rags was observed in the soil around the building. A special survey conducted October 14, 1953, in the ditches north and west of Building 442 found maximum contamination of the soil to be 5×10^5 kilobecquerels per meter per kilogram (kBq/m/kg).

On March 11, 1954, standing water in a culvert 30 ft west of the building was sampled. The water was suspected to have come from snowmelt that had drained from contaminated soil near Building 442. No documentation was found that details the results of the sample analysis.

The Site Survey Annual Report for 1954 stated that soil sampling throughout the year had disclosed contamination 10 times background in the ditches near Building 442. Building 441 and Building 442 showed consistent areas of significant contamination. No documentation was found that detailed a response to the contaminated ditch areas outside Building 442. However, it was decided that composite laundry water samples should be collected before the waste was discharged to the sewer.

In September 1959, a high count was determined on a smear sample from the Building 442 dock. The contamination was cleaned in response to the high smear on the dock in October 1959. Cleaning efforts followed the rag-cleaning barrel spill in 1963, and subsequent runoff reduced the concentrations in the area to low levels. The liquid drained east into the ditch on the northwestern side of the building. Radioactivity was detected as far as the eastern end of Building 555. In 1964, the laundry was infiltrated with enriched uranium impregnated in clothes from Building 883.

The laundry facility was responsible for the decontamination of clothing from manufacturing areas at RFP. Because of this, both radioactive and chemical materials including depleted uranium, enriched uranium, and beryllium may have contributed to the contamination around the building. The rag-cleaning barrel release reportedly involved solvents and radioactive metal shavings.

Prior to 1973, the ground areas around Building 442 were known to contain very low levels of uranium. Surface radioactivity was removed to background levels during the radiometric survey.

HPGe surveys conducted during the OU 13 Phase I RFI/RI did not indicate elevated radionuclide activities. uranium-235 was present in near-surface soil above background values. Copper, lead, zinc, americium-241, plutonium-239/234, and uranium-238 exceeded background values in surface soil. Benzo(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were also detected in surface soil. PCE and TCFM were detected in soil gas samples. These data are available in the IA Data Summary Report (DOE 2000a).

Building 443 Oil Leak, IHSS 400-129

IHSS 129 is the No. 4 Fuel Oil Tank that is the southernmost of four tanks located near Building 443. The No. 3 and No. 4 tanks are no longer in use. Tanks No. 1 and No. 2 to the north are still used as "day tanks" by Building 443. The top of the No. 4 carbon-steel tank is approximately 4 ft below grade and is oriented lengthwise east to west. It is 11 ft in diameter by 27 ft in length with a total storage capacity of 19,000 gallons (DOE 1992b).

Five underground lines consisting of a steam line, return condensation line, pump line (to pump fuel oil), return line (for fuel oil), and line connected to supply tanks are connected to Tank No. 4 (DOE 1992b).

Tank No. 4 was primarily used to store #6 fuel oil from 1967 to 1984; however, #2 diesel oil was also stored in the tank during the 1970s. It was also used to store a waste mixture of compressor oil and water from 1984 to 1986 and solvent for fuel oil spills from 1967 to 1986. Tank No. 4 use was discontinued in 1986 after evidence of potential leakage was discovered. The contents of the tank were removed, although sludge may remain in the lines and the tank (DOE 1992b).

Fuel spills of #6 fuel oil associated with the four #6 fuel oil tanks were reported in 1967, 1968, and 1977, and a possible leak was reported in 1986. The Closure Plan for Tank No. 4 indicates that the tank was a potential source for leakage. The Closure Plan also indicates traces of 1,1,1-TCA and methylene chloride were detected in groundwater; however overall, Tank No. 4 leaks or spills did not impact groundwater.

During previous investigations, soil samples were collected from borings drilled to help characterize the tank area for closure. The analytes for these samples included VOCs, base neutral acids (BNAs), and metals. Results indicated the presence above detection limits of organics, including 1,1,1-TCA, methylene chloride, benzene, toluene, ethylbenzene, and total xylenes. Metals detected include aluminum, arsenic, beryllium, calcium, cadmium, chromium, copper, iron, mercury, magnesium, nickel, potassium, lead, vanadium, and zinc (DOE 1992b).

HPGe survey data collected during the OU 10 Phase I RFI/RI indicated that activities for potassium-40 and Th-232 exceeded background. These data are available in the IA Data Summary Report (DOE 2000a).

Sulfuric Acid Spill Building 443, IHSS 400-187

A sulfuric acid spill (IHSS 187) occurred on September 11, 1970, from an aboveground 3,000-gallon tank located approximately 30 ft east of Building 443. Approximately 1,500 gallons of acid spilled from the tank and drained eastward, where the acid was captured in an earthen pit and neutralized with lime. IHSS 187 is located east of Building 443 and extends into an area now occupied by Building 452. Much of the area has been graded, and buildings, tanks, and sidewalks are now present at the spill location.

Building 443 was placed in service in 1953 and houses the steam generation plant. Water is softened and transferred to boilers to make steam for use in process heating and cleaning operations. The steam boilers are normally operated using natural gas, although #6 diesel fuel is used as a backup fuel. The fuel is stored in two large aboveground tanks located

approximately one block east of Building 443. Aboveground tanks containing sulfuric acid and NaOH are located on the eastern side of the building. These materials are used for boiler descaling and neutralization.

The 3,000-gallon acid tank associated with IHSS 187 was salvaged from Building 881, where it had been stored an estimated 8 to 10 months after decontamination. At the time of installation, the drain line was equipped with a nonstandard valve and flange. The piping system was hydrostatically tested on July 2, 1970. The tank was filled with water, left for three weeks, and determined to have no leaks. After the water was drained from the tank, the valves and gaskets were changed.

From the drain valve of the acid tank, a pipe extended to a 200-gallon mixing tank situated over a 7,000-gallon concrete, PVC-lined neutralizing tank inside Building 443. Before filling the acid tank, it was verified that the tank was empty by opening all valves and noting that no drainage occurred to the mixing tank. The tank was filled with acid on September 2, 1970. During filling, it was discovered that the level indicator was not functioning, which resulted in an overflow of approximately 0.5 gallon of sulfuric acid. Another spill occurred when the transfer hose was removed and drained. Both spills were neutralized with caustic. The tank was locked out.

On September 11, 1970, a sulfuric acid stream approximately 1/4 inch in diameter was found spraying out approximately 4 ft from the flange above the drain valve. After discovery of the leak, Fire Department personnel began spraying the tank and surrounding area with water. High winds were carrying the acid and fumes to the south and east; therefore, this procedure was curtailed. Lime was added to neutralize the sulfuric acid.

The lockout chain was cut, and the acid was allowed to drain to the mixing tank inside Building 443. The mixing tank was adapted with a flexible hose that would let the acid drain into the neutralizing tank. Approximately 9 hours after the leak was detected, the tank was completely emptied.

Because the tank was not equipped with secondary containment, the acid from the flange drained through a culvert under Fifth Street and along a ditch south of Building 442. The acid continued to flow northward along a north-south ditch east of Building 442 and west to ponds that were constructed to contain the acid. One pond measured roughly 74 ft by 25 ft, and the other was approximately 25 ft by 25 ft.

On September 12, 1970, it was discovered that the neutralization tank inside Building 443 was leaking from the drain valve into the sanitary sewer line and into the sewage treatment plant (Building 995). The acid was transferred from the neutralization tank to 25 polyethylene-lined barrels placed near earthen pits. The investigative report on this incident states that a dike surrounded the drums; however photographs taken on September 14, 1970, do not show a dike (DOE 1992a).

The drain valve on the neutralization tank had not been inspected since its installation in 1966. Dirt was found on the acid tank, which may have contributed to the inadequate closure of the neutralization tank valve.

No documentation was found that detailed the removal of contaminated soil; however, photographs indicate soil excavation immediately adjacent to the tank. The CEARP Phase I document (DOE 1986) considered that this procedure would create by-products that were benign and highly mobile; therefore, no environmental hazard should remain.

Assuming that the acid tank was filled to capacity (3,000 gallons), approximately 200 gallons of acid are unaccounted for in the description of the incident. Approximately 1,500 gallons are reported to have leaked from the leaking flange directly to the ground. An additional 1,300 gallons were recovered from the neutralization tank. The remaining 200 gallons probably leaked from the neutralization tank into the sanitary sewer system. The Building 994 sewage treatment plant and its effluent were monitored to assess the impact of the spill. On September 12, the pH of Building 995 influent was as low as 1.8. On September 13, the effluent had a pH of 2.2 with a sulfate concentration of 1,120 ppm. It is probable that the sulfuric acid leak into the sanitary sewer system contributed to the acidic treatment plant water.

HPGe survey data collected during the OU 12 Phase I RFI/RI indicated slightly anomalous uranium-238 values at several locations. Surface soil sample analysis indicated that americium-241, gross beta, plutonium-239/240, radium-226, radium-228, uranium-238, and uranium-235 were above background values. These data are available in the IA Data Summary Report (DOE 2000a).

IHSS GROUP 400-8

Office Building, UBC 441

Building 441 is located in the northwest portion of the 400 Area and was placed into service in 1952. The building footprint is approximately 17,075 ft². The building was originally used as a laboratory, and in 1966, was converted into an office building. Because the footprint of the building overlaps IHSS 122, the soil beneath the building is potentially affected by nitrates, volatiles, PCBs, and radioactive contaminants. No characterization has been performed of the soil underlying the building (DOE 1992a).

Underground Concrete Tank, IHSS 400-122

There are two interconnected underground tanks south of Building 441. Both tanks are concrete and each has a capacity of 3,000 gallons. The tanks were part of the OPWL system and were used to handle the waste from Building 123 and Building 441 and possibly from Building 122 and Building 444. Interviewees for the CEARP Phase I document mentioned that leaks might have occurred. At times, the tanks were known to fill with groundwater, which was pumped out and sent to waste treatment.

The tanks were originally 60 ft south of Building 441. In 1966, the Building 441 addition was constructed over approximately 7.5 ft of the existing tank system. At this time, portions of the tank walls may have been removed to accommodate the construction of Building 441.

The tank system consists of two tanks. One is constructed of concrete with a partial limestone lining and is located beneath the building. The other is a two-chambered tank that is located underground directly outside the building. The two-chambered tank received inflow from the limestone tanks and has a combined capacity of approximately 6,000

gallons. Because of the conversion of Building 441 activities, waste was no longer generated from this source; however, both tanks may have received waste from Building 123 as late as June 1966.

Documentation was found for only one release from these tanks. On June 1, 1953, the tanks overflowed by approximately 1,200 gallons. The spill consisted of process waste from Building 123. In 1953, the system was modified to allow liquid wastes to be released directly to the sanitary system, therefore reducing the amount of waste passing through these tanks.

The tanks were known to store process waste from Buildings 441 and 123. Nitrates and radionuclides were assumed to be present. One reference describes the waste as having total dissolved solids ranging from 532 to 965 ppm and a pH that ranged from 7.15 to 5.85. Limestone was used to help control the acidic nature of the waste.

A telephone interview was conducted on November 14, 1991, with RFP Liquid Waste Operation personnel. It was stated that the limestone tank might contain groundwater seepage; however, it is no longer pumped or checked.

***Tank 2 - Concrete Waste Storage Tank and Tank 3 - Steel Waste Storage Tank
IHSS 000-121***

Tanks 2 and 3 are interconnected tanks located in the 400 Area, along the southern wall of Building 441 near its southwestern corner. Tank 3 refers to the 3,200-gallon carbon steel AST and an underlying 3,000-gallon concrete storage tank. Tank 2 is an underground concrete tank that partially underlies Building 441. The precise location of the underground tanks and the tank designation are not clear. The underground tanks could not be visually inspected because of the presence of water in the vaults and the as-built drawings do not adequately describe the tanks (DOE 1969). Tank 3 is assumed to be steel, and Tank 2 is assumed to be an underground concrete tank that has three concrete access chambers overlying the tank. The field inspection could not determine whether the tank underlying these vaults extended under Tank 3, nor could the field inspection assess the condition of the underground tank(s).

Tanks 2 and 3 were installed in 1952. The underground concrete tanks and the AST were abandoned in June 1982 after reportedly being decontaminated, filled with gravel, and covered with concrete (DOE 1969). However, the reference to being filled with gravel probably refers to the part of Tank 2 that underlies the addition to Building 441, whereas the other part of Tank 2 that is outside the building probably remains intact. The as-built drawing for this tank indicates that a separate chamber to this tank lies entirely outside the building foundation (DOE 1969). Furthermore, no gravel underlying the three concrete access chambers was noted during the limited visual inspection of Tank 2. Information also indicates that a pipe directed effluent to this part of the tank so that the other parts could be filled with gravel upon construction of the structure addition to Building 441.

These tanks reportedly received waste streams from Building 122, Building 123, and Building 441. Waste streams included acids, bases, solvents, radionuclides, metals, thiocyanate, ethylene glycol, trace PCBs, bleach, soap, blood, and hydrogen peroxide.

Tank 3 reportedly last stored ammonia after storing several other wastes. This site has been identified as a known release location (DOE 1992a).

HPGe surveys were conducted during the OU 9 RFI/RI and results indicated that Th-232 was slightly above background activity. NaI surveys indicated six locations above background levels. Surface soil samples were also collected and analyzed. Americium-241 and plutonium-239/240 were detected above background.

Subsurface soil samples indicated that plutonium-239/240 was above background at a depth of 0.0 to 0.6 inches and 2.0 to 4.6 ft at a location adjacent to the northwestern corner of Tanks 2 and 3. Groundwater samples at this location indicated that all Target Analyte List (TAL) metals and radionuclides except cesium, molybdenum, beryllium, and silver exceeded background levels. Plutonium-239/240 and lead were detected above background at 0 to 6 inches bgs adjacent to the southwestern corner of the tanks. Groundwater samples at the same location indicated that americium-241, uranium-233/234, uranium-238, aluminum, arsenic, barium, lead, manganese, potassium, sodium, and strontium exceeded background.

Soil samples from the borehole located adjacent to the south side of Building 441 indicated that americium-241, plutonium-239/240, and lead exceeded background at a depth of 0.0 to 6.0 inches. Plutonium-239/240, uranium-238, and lead exceeded background at a depth of 0.0 to 6.0 inches in the borehole located adjacent to the eastern side of Building 441.

Groundwater samples from the same location indicated that all radionuclides were above background, and all metals except antimony, beryllium, cadmium, calcium, cesium, molybdenum, silicon, silver, and tin exceeded background.

Soil samples from the borehole adjacent to the northeastern corner of Building 441 indicated that plutonium-239/240 and lead were above background at a sample depth of 0.0 to 6.0 inches. Groundwater samples indicated that all radionuclides and all metals except antimony, beryllium, cadmium, calcium, cesium, molybdenum, silicon, silver, and tin exceeded background levels. Soil data are available in the IA Data Summary Report (DOE 2000a).

Samples collected of the liquid in the Tank T-2 vault indicated that every radionuclide analyzed had positive activity, with gross alpha/beta, uranium-233/234, uranium-235, and uranium-238 having moderate to high activity.

IHSS GROUP 400-10

Sandblasting Area, IHSS 400-807

No documentation could be found that details the dates that sandblasting began in the 400 Area. The first documented incident occurred in May 1976. References state that sandblasting of ATMX railcars took place "north of Building 664," "inside the fence east of 44," and "east of Building 439."

In September 1976, Industrial Hygiene personnel initiated the substitution of alumina grit for flint sand because of its lower toxicity.

Fiberglass Area West of Building 664 IHSS 600-120.2

Building 664 became operational in 1972 and was used for storage, staging, loading, and shipping of radioactive wastes. Building 664 contained a fiberglass application operation and a real-time radiography unit.

The fiberglassing area west of Building 664 (IHSS 120.2) is fully encompassed by IHSS 161. IHSS 161 may contain low-level residual plutonium and uranium contamination resulting from punctured or leaking drums and boxes of solid and liquid wastes.

IHSS 120.2 was used as an area for fiberglassing in conjunction with operations at Building 664 and is located on the western side of this building. The IHSS is generally paved with asphaltic concrete; however, some areas are unpaved. The unpaved areas are in the southern and western portions of the IHSS. Sediment in the eastern portion of the IHSS next to Building 664 indicated that water ponded in this IHSS.

HPGe surveys conducted during the OU 12 Phase I RFI/RI indicated that americium-241, plutonium-239, and uranium-238 were elevated at this IHSS. Surface soil samples indicated the presence of americium-241, uranium-233/235, uranium-235, and uranium-238. These data are available in the IA Data Summary Report (DOE 2000a). Acetone, benzene, ethylbenzene, methane, toluene, and total xylenes were detected above background in soil gas.

Radioactive Site West of Building 664 IHSS 600-161

Persons interviewed for the CEARP Phase I report indicated that the area west of Building 664 may contain low-level residual contamination from plutonium and uranium resulting from punctured or leaking drums and boxes of solid and liquid wastes. Building 664 was constructed in 1971 and is used to stage drummed and boxed waste prior to off-site shipment for disposal. A review of aerial photographs revealed no apparent activity in the area prior to the construction of Building 664 in 1971. No records documenting discrete releases in this area were found.

Results of an aerial radiometric survey conducted in 1977 indicated an area of elevated americium and gamma activity concentrations around the northwestern corner of Building 664. Plutonium- and uranium-contaminated liquid and solid wastes staged in Building 664 are the likely residual constituents that led to the elevated radiation readings.

In November 1988, a forklift leaked hydraulic oil outside Building 664. The cause was the rupture of a 1-inch hose on the forklift. The oil spread over the asphalt area and adjacent ground.

Soil was reportedly removed from this area in the early 1970s. No documentation was found that provides details of any soil remediation activities.

IHSS GROUP 500-1

Valve Vaults 11, 12, and 13 IHSS 300-186

Valve Vaults 11, 12, and 13 are located inline along the process waste line south of Building 374 and west of Building 552. Several incidents have occurred in one or more of the valve

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vaults resulting in the release of process waste to the environment. Process waste lines connect the valve vaults and containment lines surround the pipes. In addition to the double-contained lines, the process waste lines are equipped with leak-detection sensors.

The first incident related to these valve vaults for which documentation was found was on June 12, 1985. Contractors excavating a drainage ditch along the south side of the PA in the northeastern corner of the Building 371 parking lot broke the outer containment of four lines and the inner line of the low-level transfer line near Valve Vault 13. Soon after it was broken, pumping began from the process waste tanks in Building 460 to Building 374, allowing liquid to be released from the inner pipe.

In June 1986, corrosion of a 1-inch-diameter hole in a black iron flange, which was connected to a stainless-steel piping system, caused a release of process waste into Valve Vault 13. The sump pump recirculated the liquid in the vault. The sensor alarm sounded but was not responded to until the next day.

Leakage of the process line between Valve Vault 12 and Valve Vault 13 was reported on October 24, 1986. The process waste lines are designed to provide a constant slope between adjacent valve vaults to allow any liquid in the containment pipe to flow into a vault and trigger an alarm. No alarm sounded when the release occurred. It was determined at the time the leakage occurred that the lines had been previously repaired and reworked in 1981 or 1982 and that they were not replaced in a manner that allowed drainage. (No documentation could be found as to why the lines were repaired or replaced.) Instead, a trap was created, allowing saturation of the bedding material and soil around the pipe.

On June 1, 1987, a radioactive leak was discovered near Valve Vault 13 when contamination was found in the culvert drain collection basin. The leak was found to be in the high-level transfer line between Building 374 and Valve Vault 13.

On September 13, 1988, Valve Vault 12 was flooded with 1,700 gallons of high nitrate solution during transfer between Building 774 and Building 374. A connection at a tygon tube became separated which allowed the leak to occur.

In October 1989, a significant amount of liquid was found in Valve Vault 11, Valve Vault 12, and Valve Vault 13. The alarms had sounded in the Building 231 Pump House, Pump Station #1, and Valve Vault 19, but upon inspection no problems were found at these locations. The inspection continued and resulted in the discovery of liquid in Vaults 11, 12, and 13.

Details of the spill in 1985 indicated a pH of 5 and 6 on litmus paper with a laboratory analysis of 7.2. The process waste consisted of Oakite and distilled water. It was estimated at the time that 1,700 gallons of liquid were pumped, but only approximately 4.4 gallons were spilled onto the ground.

The pipe was repaired after the 1985 incident. Investigation at that time revealed no radioactive contamination. In June 1986, the black iron flange was replaced with a stainless-steel flange with no release of contamination. These repairs were thought to have

contributed to the leak found in 1987, because the repairs were not compatible with the original design.

The June 1986 incident involved an acidic liquid waste that corroded the iron flange. In October 1986, the soil surrounding the pipe was saturated with a yellow liquid. Monitoring of the area disclosed alpha, beta, and uranium-238 contamination of up to 1.7×10^5 , 5×10^4 , and 9×10^2 pCi/L, respectively. Analytical results from water samples indicated the presence of uranium, americium, plutonium, total alpha activity, and total beta activity.

After the leak had been detected in October 1986, an area 30 ft by 100 ft was excavated to locate the leak in the process waste lines. The repairs were completed on November 13, 1986. A series of small cofferdams was built to contain surface water and groundwater, and the collected fluids were eventually removed by a tank truck and placed in SEP 207-A. Approximately 24 waste boxes of uranium-contaminated sand and gravel were shipped off site for low-level radioactive disposal. Cleanup was completed on December 8, 1986, by reducing the radiation levels to slightly above background. The area was backfilled.

A radioactive acidic solution was released in the June 1987 incident. Analytical results from samples collected in the culvert drain collection basin showed 42,000 pCi/L gross alpha activity and 13,000 pCi/L gross beta activity.

In response to the culvert contamination in 1987, dikes were installed in the drain path to prohibit further draining. Liquids were drained from the transfer pipe and pumped to a mobile tanker. The culvert was taken out and soil was removed until both alpha and beta counts were below 250 cpm. A work order was submitted to install a leak-detection device; however, it is not known whether this was complete. The high- and low-level transfer lines were replaced with fibercast piping and repaired to the original design specifications.

The liquid that leaked in 1989 was approximately 10,000 gallons of SEP water with a pH of 7.5 to 8.0. Analytical results of radioactivity levels indicated 3,122 to 7,134 pCi/L gross alpha activity.

A document written in May 1989 indicated that backfilling of an excavation at this valve vault would have to be delayed for over a year because of legalities in dealing with the contaminated waste. This excavation may be due to the flooding incident in 1988.

The supervisor of Building 374 ordered pumping to be stopped from Building 778 and Building 774 in response to the 1989 incident. The RCRA/ Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) office was notified. The appropriate lockout/tagouts were provided on the valves in Valve Vault 12 and in the Building 231 Pump House. The liquid was removed and repairs to the line were completed by October 22, 1989. The line flow-tested successfully. A RCRA CIPR (89-015) was prepared and submitted on this incident.

Scrap Metal Storage Site IHSS 500-197

In approximately 1958, scrap metal components, mostly from the original Plant construction program, were buried in trenches west of Building 559. Some of the buried material was recovered from process areas. Another source states that the burial probably occurred in the

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early 1960s. The site was probably used by the Austin Company for disposal of construction debris during early building activities.

Some of the scrap metal material recovered from the process areas and buried in the trenches could have been radioactively contaminated. There is a slight possibility that transformers containing PCBs were disposed of at this site.

In 1981, excavation for the construction of the PSZ unearthed the scrap metal burial sites. RFP personnel remediated the site by complete excavation of the trenches and removal of the buried material to the sanitary landfill (PAC NW-114). Another reference states that there was a second scrap metal burial site, located west of Building 559 and northwest of the first site, which was also unearthed at the time of the PSZ construction.

North Site Chemical Storage Site, IHSS 500-117.1

An area northeast of Building 551 was used as a general warehouse storage yard prior to September 1959 until the early 1970s. In September 1959, routine monitoring of the aluminum scrap pile near Building 551 showed an occasional buildup of radioactive material. In May 1963, uranium chips and turnings were discovered at this site in an aluminum scrap pile. A similar incident involving 40 drums of contaminated aluminum scrap occurred in 1964. In May 1964, 40 drums of contaminated aluminum scrap were dumped into the acid waste in SEP 207-A (PAC 000-101).

Forty drums of aluminum scrap metal contaminated with uranium chips and turnings were discovered in the storage yard. In September 1959, an approximate 1 ft² area of the aluminum scrap pile near Building 551 showed a direct measurement of up to 20 millirems per hour (mr/hr).

The aluminum scrap pile near Building 551 was routinely monitored in September 1959 for radioactivity. In the early 1970s, material in the general warehouse storage yard was transferred to the PU&D Storage Yard southwest of the Present Landfill.

Surface soil samples collected during the OU 13 Phase I RFI/RI indicated that plutonium-241, copper, mercury, lead, selenium, silver, and zinc were present above background levels. Acetone, benzene, PCE, TCE, TCFM, and toluene were detected in soil gas samples. These data are available in the IA Data Summary Report (DOE 2000a).

IHSS GROUP 500-2

Radioactive Site Building 551 IHSS 500-158

There may be residual contamination from leakage of waste boxes loaded into railroad container cars in the area north of Building 551. In September 1959, three containers measuring 6,000 to 40,000 cpm were held back from off-site shipment. On June 7, 1961, isolated spots of contamination up to 8,000 cpm were found on the dock and in the helium storage area of Building 553. Empty drums contaminated with uranium from off site were received at Building 551. In October 1962, spot checks of one load of approximately 220 drums indicated they were generally contaminated up to 1,200 cpm on exteriors and up to 7,000 cpm on the interior surfaces. In July 1963 and again in 1970, RFP received equipment and drums from off site that contained uranium above the acceptable level.

Spots of contamination (found in June 1961) on the dock and in the helium storage area of Building 553 were cleaned. In 1970, an entire shipment of 55-gallon drums was returned to the vendor.

Surface soil samples collected during the OU 13 Phase I RFI/RI indicated that americium-241, plutonium-241, uranium-233/234, uranium-235, uranium-238, copper, chromium, lead, and zinc were present above background levels. These data are available in the IA Data Summary Report (DOE 2000a). Acetone, benzene, bromomethane, chloroethane, dichlorodifluoromethane, 1,1-dichloroethene, cis-1,2-dichloroethene, ethylbenzene, n-propylbenzene, PCE, TCE, TCFM, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, toluene, vinyl chloride, and xylenes were detected in soil gas samples.

IHSS GROUP 500-3

Service Analytical Laboratory, UBC 559

Information on Building 559 is from the HAER (DOE 1998a) and HRR (DOE 1992a). The plutonium laboratory was constructed in 1967, and first began operations in January 1968. Samples of recovered, cast, and purified materials from the Plant were analyzed in the lab. The building contained laboratory facilities for conducting spectrochemical, chemical, and mass spectrometric analyses. In 1973, the construction of Building 561 expanded the capabilities of the laboratory. Support tasks in Building 559 included primary analytical support for Building 707 production contingency, Raschig ring analysis and certification, duct remediation, analysis and characterization of LLW, and analysis of contaminated PCBs. Later projects included the Waste Isolation Pilot Project Bin and Alcove test program, the WSRIC program, and consolidation and stabilization of nuclear materials.

There were two analytical laboratories present in the structure. The production support and Plant support laboratories shared equipment and space. The area along the north side of the building was divided into rooms for offices, radiation monitoring, a computer room, restrooms, a locker room, storerooms, and maintenance equipment. Four large areas along the south side and eastern end of the building were used for mechanical equipment and laboratories. Specific laboratories included the spectrochemical analysis laboratory, chemistry laboratory, and mass spectroscopy laboratory. Radioactive materials processed in the laboratories were received and shipped from a loading dock on the south side of the building. A second loading dock at the western end was used to receive building supplies.

In the production support laboratory, quantitative and qualitative chemical analyses for plutonium production operations were performed to ensure that raw material used in manufacturing processes were within specifications, Plant processes produced materials that met specifications, and final products conformed to requirements. Quantitative analyses included gallium in plutonium alloy, plutonium assay, carbon-hydrogen-nitrogen contents, ion analysis, tritium content, emission spectrometric analysis, atomic absorption, coulometric analysis, x-ray fluorescence spectroscopy, and identification of various isotopes. Samples consisted primarily of plutonium or other metals and their alloys, oxides of plutonium, uranium, solutions of plutonium or other elements, and various gases. Materials in process were held at given stages in their sequence of operations until results of sample analyses were obtained and verified. Small samples of solids or liquids were transferred from

production areas to the laboratories, where exact sample aliquots were prepared from the production samples. These samples were transferred to appropriate instruments for analysis.

The Plant support laboratory personnel performed analyses on materials from Plant support functions indirectly related to production activities (for example, radiation monitoring and waste treatment). This group performed mass spectrometry analyses of isotopes of plutonium, uranium, lithium, and boron (thermal ionization); organic compounds; gases; operational processes; and using spark ionization. Other analyses included infrared analysis to determine impurities, thermal characterization analysis to determine changes in phase as a function of temperature, and titrimetry to determine water content of organic solvents.

The facility was originally built with Pyrex glass waste lines in 1968. Less than a year after construction, a break was discovered. In 1972, PVC pipe was installed as a replacement. Core sections taken beneath the building confirmed some infiltration.

Temporary Waste Holding Building, UBC 528

Information on Building 528 is from WSRIC (RMRS 2000f). Building 528 houses two storage tanks that hold process wastes from the Building 559 analytical laboratories and plenum fire water from Building 561, until the wastes are pumped to Building 374 for treatment. Wastes from Building 559 include wash water and expired reagents, such as ceric sulfate, HNO_3 , and KOH ; aqueous standards from the laboratory sinks; a waste solution containing solvents and acids; and waste water from the decontamination room. These wastes are accumulated in 55-gallon drums in Building 559, then transferred to Building 374 by tanks. Occasional building cleanup, maintenance, and refurbishing activities generate waste, which is transported to Building 559 for eventual disposition.

Radioactive Site Building 559 IHSS 500-159

When Building 559 began operation in March 1968, the process waste system consisted of Pyrex glass lines beneath the building and adjacent support buildings. Less than 1 year later, a break was discovered in the process waste line from the building to the pump house. In May 1972, the south half of the process waste line beneath Building 559 was discovered to be leaking. Additionally, the rupture of the process waste line from Building 559 to the process waste tank valve pit caused soil contamination with an activity of 4,500 pCi/g. The contamination decreased from the pit to the concrete pad along the south side of Building 559.

In May 1977, influx of contaminated groundwater was discovered in the manhole next to the southwest corner of Building 559. The contamination was believed to be residue from the 1972 occurrence. Also in May 1977, 4,600 gallons of contaminated water leaked into a process waste collection tank in Building 528. The water leaked through a drip leg of the double-contained process waste lines and was fed by a broken 3-inch PVC process waste supply line from Building 559 to Building 561. Gross alpha in the water from the drip leg was measured at 160,000 pCi/L. It was concluded that the process water supply line, process line, and shell of the process waste line were probably broken. The primary material of concern is process waste generated at Building 559. Typically, process waste consists of an aqueous solution with radioactive constituents.

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In 1968 and 1972, contaminated soil from over and around the process waste line to the process waste tank pit was removed and shipped to Idaho for disposal as radioactive waste. In 1968, the infiltrated soil removed for off-site disposal had a surface area of several hundred ft². In 1972, a PVC pipe bypass of the Pyrex line beneath the south half of Building 559 was installed and the remaining lines were static leak-tested. In May 1972, 82 drums of contaminated soil were removed from over and around the process waste line from Building 559 to the process waste tank pit south of the building. The soil under the process waste line was not removed. In May 1977, water samples were collected at the process tank building, steam pit, Building 561, and footing drain manhole south of Building 559. Also in May 1972, the pit building was decontaminated. In addition, Building 559 terminated the generation of process waste water, and groundwater was pumped from the footing manhole to the process waste holding tanks. No documentation was found that indicated the duration for which process waste generation was terminated.

Tank 7 - OPWL - Active Process Waste Pit IHSS 000-121

Tank 7 is located in the 500 Area within Building 528, which is referred to as the Building 559 Process Waste Pit. This tank is located approximately 30 ft southeast of Building 559. Tank 7 consists of two 2,000-gallon, in-sump steel tanks within an underground concrete vault.

Tank 7 was reportedly installed in 1969 and received waste streams from Building 550, the Analytical Laboratory, including acids, bases, solvents, radionuclides, metals, pesticides, herbicides, and possibly PCBs. The tank was used as a 90-day TRU waste tank, according to Building 559 personnel. This tank has been identified as a known release location at its connection with Pipe P-16 (DOE 1992a).

HPGe surveys indicated elevated levels of americium-241 and plutonium-239/240. These levels increased as they got closer to Building 569. Three NaI locations had activities from 1,500 to 2,500 cpm with background levels in the same range.

Soil from a borehole located adjacent to the northwestern corner of Tank T-7 had plutonium-239/240 activities greater than background at a depth of 0.0 to 0.5 ft. In a groundwater sample at the same location, arsenic, barium, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, strontium, and zinc concentrations exceeded background. Gross alpha, gross beta, uranium-235, uranium-233/234, and uranium-238 activities were above background. In a groundwater sample at the borehole adjacent to the northeastern corner of Tank T-7, arsenic, strontium, manganese, sodium, zinc, uranium-233/234, and uranium-238 exceeded background concentrations.

Tank 33 - OPWL - Process Waste Tank, IHSS 000-121

Existing data for this site have not been located.

Tank 34 - OPWL - Process Waste Tank, IHSS 000-121

Existing data for this site have not been located.

Tank 35 - OPWL - Building 561 Concrete Floor Sum,p IHSS 000-121

Existing data for this site have not been located.

IHSS GROUP 500-4

Middle Site Chemical Storage, IHSS 500-117.2

There were minor leaks and spills in the chemical storage area east of Building 551. An inspection in approximately 1971 revealed several drums that were leaking an oily substance. Constituents released included acids, oils, soaps, solvents, and beryllium scrap metal. On October 20, 1986, a 55-gallon drum of aluminum nitrate was punctured by a forklift east of Building 551. Most of the 55 gallons flowed out and across the roadway to the east.

In the early 1970s, a recommendation was made to repack leaking drums in the storage area. The chemical storage area east of Building 551 was covered with asphalt sometime during the 1970s. The October 20, 1986, incident was controlled with no environmental damage.

Surface soil samples collected during the OU 13 Phase I RFI/RI indicated that americium-241, plutonium-241, radium-226, chromium, lead, nickel, and zinc were present above background levels. These data are available in the IA Data Summary Report (DOE 2000a). Acetone, benzene, bromomethane, chloroethane, dichlorodifluoromethane, 1,1-dichloroethene, cis-1,2-dichloroethene, ethylbenzene, naphthalene, n-propylbenzene, PCE, TCE, TCFM, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, toluene, vinyl chloride, and xylenes were detected in soil gas samples.

IHSS GROUP 500-5

Transformer Leak - 558-1, PAC 500-904

Transformers 223-1 and 223-2 are located north of Building 549. These transformers leaked small amounts of oil prior to 1987. In February 1986, the valve, tap changer, and bushings of Transformer 223-1 were reported leaking. In January 1987, residual staining was noted on the concrete pad underlying Transformer 223-2.

In approximately 1985, analytical results indicated the oil in Transformer 223-1 contained over 500 ppm PCBs and the oil in Transformer 223-2 contained less than 50 ppm PCBs. In October and November 1985, it was reported that fluid in Transformers 223-1 and 223-2 contained 19,800 and 296 ppm PCBs, respectively. In November 1986, a smear sample collected from the concrete underlying the drain valve of Transformer 223-1 indicated less than 50 micrograms of PCBs. Oil containing less than 50 ppm PCBs was released from the transformers.

In February 1986, the valve, tap changer, and bushings of Transformer 223-1 were scheduled for repair. In June 1986, several actions were recommended for planning and early implementation with respect to four transformers, including Transformer 223-1. The following actions were recommended: leaking fluid be contained and properly disposed; the transformers be expeditiously repaired or replaced; and any associated contamination be satisfactorily decontaminated. Also in June 1986, Transformer 223-1 was scheduled for fluid cleansing or exchange. In January 1987, it was recommended that the concrete pad underlying Transformer 223-2 be coated with sealant. In March 1989, it was reported that Transformer 223-1 was replaced under the Environmental Hazards Elimination Project. The transformers were retrofilled with non-PCB cooling oil in 1987.

IHSS GROUP 500-6

Asphalt Surface Near Building 559, IHSS 500-906

Approximately 1 gallon of F001 waste water spilled from a hose that was used to extract excess water from a tanker. The water was from the P304 sump that collects water from the exterior of the Building 559/561 tunnel and the Building 561 basement. Normally this water is released into the surface water drainage system through pumping to a footing drain system that flows by gravity. However, the water in question was found to exceed Segment 5 stream standards for some analytes, and was thus being removed by tanker. The tanker was accidentally filled beyond the level allowed by Rocky Flats Transportation Guidelines. These guidelines require that no more than four-fifths of the capacity of the tanker be used. After approximately 1,000 gallons of water had been offloaded from the tanker into drums, the hose that was used leaked some water as it was transferred back to storage.

The water contained F001 hazardous waste constituents including carbon tetrachloride, TCE, and 1,1-dichloroethene, based on four sampling events that occurred from July 1992 through March 1993. Chemical analytes covered by TCLP were also identified, but the concentrations were below those of a characteristic RCRA hazardous waste. Contamination levels exceeded Segment 5 stream standards for some constituents.

Oil-dry was used to absorb the water; the wet oil-dry was then managed as RCRA-regulated hazardous waste. Portions of the release were absorbed by the asphalt and evaporated into the air. Spill pans are now being used during transfer operations.

IHSS GROUP 500-7

Tanker Truck Release of Hazardous Waste from Tank 231B, IHSS 500-907

At approximately 9:30 a.m. on July 13, 1994, during a RCRA tank inspection, evidence of a release was observed near Building 231. At the time of the discovery sludge was being transferred from Tank 231B to a tanker truck in an effort to lower the level of sludge in the stationary tank for a valve repair job. Approximately 0.5 pound of dried sludge was released to the soil.

At this same location on July 20, 1994, 4 gallons of liquid from the tanker were released to a secondary containment spill basin when a hose coupling was unlocked. It was estimated that more than 1 pound of liquid was sprayed onto two workers and adjacent soil both east and west of the spill basin. The workers were taken to Building 374 and decontaminated in accordance with the DOE Radiological Control Manual requirements and implementation procedures. Nasal swipes were collected from the workers and counted for radiological contamination. Subsequent internal dose calculations for one of the workers confirmed a 12 millirem exposure, which is considered a negligible dose over a 1-year time frame. The second worker showed no measurable contamination from the swipes. Radiological surveys of the surrounding soil and basin area were conducted using a Bicron and SAC-4 instrument. The highest detected level of radioactive contamination was 651 dpm. Contaminated soil was containerized and the basin area was decontaminated.

The material released from tanker truck No. 6 on July 20, 1994, was rinse water used to flush the transfer line and tanker drain hose. The sludge from the tanker contained an F-listed

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waste; therefore, the rinse water was treated as hazardous waste under the mixture rule. EPA waste codes assigned to the waste contained in the 231 tank system include D004, D006, D007, D008, D009, D010, D011, F001, F002, F003, F005, F006, F007, F009, and F039. No residual contamination was detected in preliminary samples.

The area was cordoned off and posted immediately due to the radiological contamination. A wet vacuum was used to remove the liquid from the spill basin, and radiological control technicians (RCTs) smeared the tanker and the basin area. Approximately 30 pounds of soil were removed on July 13, 1994, from the first release, followed by an additional 40 pounds of soil from the second release on July 20 and 21, 1994. The soil was containerized in a drum and is being managed as low-level mixed hazardous waste in RCRA Unit 200.

The RCRA Contingency Implementation Plan was initiated on July 20, 1994, as a conservative measure, due to the release from containment to the environment of approximately 1 pound of hazardous waste. Samples were collected from the wet vacuum, tanker drain hose, and surrounding soil (prior to and after excavation).

IHSS GROUP 600-1

Temporary Waste Storage - Building 663, PAC 600-1001

Two temporary buildings were constructed on concrete slabs for use during the original Plant construction in the early 1950s. These buildings were located where Building 662 and Building 663 are currently located. The wooden structures were removed prior to 1954; however, the concrete slabs remained. The slabs from Buildings 662 and 663, as well as the area around them, were used for storage purposes.

In April 1954, it was proposed that the Building 663 slab be used for temporary storage of noncombustible waste awaiting disposal. It is believed from the research on the HRR (DOE 1992a) that the slab is also known as the East Slab, because it is located east of Building 334 and Building 444. Most of the waste stored at Building 663 came from these two buildings.

Storage operations began in May 1954, when 302 drums of graphite and 49 drums of liquid waste were placed on the Building 663 slab. Waste coolant drums were also stored on the slab. In November 1954, all of the drums were removed from the slab; however, storage at the area later resumed.

The area was found to be an advantageous loading area, and plans were made to convert the slab into a loading facility. On May 25, 1955, approval was requested for the conversion of the slab east of the Building 663 slab, which is the current location of Building 662, to a loading facility. The northern end of the loading facility was reinforced and refinished with concrete in October 1958.

On October 15, 1960, a waste storage building was erected on the Building 663 slab. Accumulated drums of waste from the production buildings were moved to the building upon completion of construction. In November 1962, drums and boxes of waste from Buildings 771 and 774 were moved to the western side of Building 663 for outside storage.

Documented releases occurring at these storage areas.

On November 16 and 17, 1954, 59 drums of contaminated waste were moved from the concrete slab (Building 663) to the Mound for burial (PAC 900-113). At this time, many drums were found to be in poor condition. Drums of liquid wastes, which had been placed at the storage area in April 1954, had corroded and developed leaks. The southern side of the concrete slab was contaminated as a result of these pinhole leaks. At the time of the discovery of the leaking drums in 1954, one drum of still bottoms was placed in a 55-gallon drum. It was stated that the southern end of the concrete slab would have to be decontaminated because of the leaks; however, no documentation was found that detailed cleanup activities.

On September 5, 1958, a drum on the East Slab containing highly contaminated coolant was punctured. As a result, the slab was contaminated with up to greater than 100,000 cpm direct reading, and up to 20,000 cpm removable contamination. Subsequently, the drum contents were pumped to another drum, and the area was cleaned "to a certain extent." Drums in the surrounding area were moved, and cleaned if contaminated. The last drum was moved on September 25, 1958. Access was restricted to the area, and it was stated that the area would be cleaned more thoroughly.

Routine smear surveys conducted at the East Slab in August 1959 indicated a maximum reading of 108 dpm, and an average reading of 16 dpm. The high reading was taken from a roped-off area of the slab. Spot checks indicated direct readings of 100,000 cpm in this area. No documentation was found that explained why the area was roped off.

Routine smear surveys conducted on the East Slab in March 1960 indicated a maximum reading of 1,734 dpm, and an average reading of 67 dpm. Fifty-nine drums at the East Slab were surveyed, resulting in a maximum beta-gamma reading of 0.4 mr/hr.

Also during March 1960, the lids of two waste drums from Building 883 came loose, resulting in contamination of approximately 2 ft² of slab, to 3,000 cpm, with solid material. Additionally, a waste drum from Building 881 was found to be leaking. Direct readings up to 300 cpm were found. The drums with the loosened lids were returned to Building 883 to be resealed, and the area was cleaned. The leaking drum from Building 881 was also returned, and the affected area was scrubbed and hosed off.

During May 1960, three waste drums from Building 881 were found to be leaking. The drums were returned. Acidic waste material was being released from the corroded drums and contaminating the loading facility. In response to the leaking drums in May 1960, up to 3,000 dpm was removed by scrubbing. Decontamination of the loading facility took place during May 1960; however, it is unknown whether this was due to the corroding acid waste drums, a previous incident such as the March 1960 releases, or all of these incidents.

Routine smear surveys conducted on the East Slab in June 1960 indicated a maximum reading of 126 dpm, and an average reading of 21 dpm.

During June 1960, a drum from Building 881 leaked on the East Slab. The drum was returned, and no contamination was found on the slab.

Routine smear surveys conducted on the East Slab in August 1961 indicated a maximum reading of 24 dpm, and an average reading of 6 dpm.

During August 1961, leaking drums from Building 444 and Building 776 were monitored many times. No contamination was found. The leaking drums were returned. The leaks resulted in no detectable contamination.

During loading operations on March 19, 1963, a leaking drum was discovered. The liquid was determined to be radioactive. The ground, forklift, and trailer were contaminated. The contents of the drum and the quantity released were not documented. In response to this leaking drum, the ground was covered with gravel, and the equipment was decontaminated. The leaking drum was returned to its origin, Building 771.

On March 26, 1963, a leaking waste drum in the area outside of Building 663 resulted in the contamination of a forklift, truck trailer, cross bar, lining in a truck trailer, the fork lift operator, a laborer, and the ground. Other documentation states that during loading operations in March 1963, three "leakers" were discovered. The trailers, two forklifts, the work area, and personal clothing were contaminated. It is unknown whether these two reports discuss the same incident or two separate incidents. No documentation regarding the contents of the drums or the extent of the ground contamination was found for either case. Following the March 26, 1963, incident, or incidents as the case may be, the contaminated drum and trailer lining were removed. The underlying floor of the trailer was "cold." The cross bar was decontaminated and the lining was replaced.

A waste drum leak on September 17, 1963, contaminated a fork truck, panel truck, and semi-trailer at Building 663. No documentation was found that detailed the contents of the drum or release to the environment.

On January 12, 1990, there was a gasoline spill on the eastern side of Building 662. The gasoline was leaking from a truck. No response, other than that the problem was "corrected," was documented following the 1990 gasoline release.

Constituents that may be present due to storage activities include oil, still bottoms, perclene, waste coolant, and solids. Gasoline was released during the January 1990 incident.

IHSS GROUP 600-2

Storage Shed South of Building 334, PAC 400-802

The storage area south of Building 334 was originally a metal or wooden structure built on a concrete slab. A July 1955 aerial photograph indicates that the building had been removed but the remaining slab was not being used for storage. The first documented usage of the storage area was reported on October 24, 1955, when 125 barrels of depleted uranium chips immersed in oil were stored there. The drums developed leaks that contaminated the slab. In October 1956, one or two leaking drums contaminated the slab to 537 dpm. As of November 1956, 10 to 20 drums were leaking. On November 12, 1956, a 30-gallon drum overturned and spilled contaminated oil onto the slab.

The drums were completely removed and the slab was cleaned as of November 28, 1956. However, it was discovered that contamination had spread to equipment that was also stored there. The equipment was moved but results from slab smears indicated contamination up to 10,000 dpm. Additional monitoring conducted in December 1956 revealed that the contamination was spreading due to weather conditions. By January 1957, low-level radioactivity had extended to the fuel storage tank located south of Building 551 (PAC 600-152).

Cleanup was attempted in October 1956 when the drums were first found to be leaking. The "leakers" were placed in larger drums and contamination on the concrete slab was reduced from 537 dpm to 108 dpm using PCE. The activity from the overturned drum was cleaned up and decontaminated to a "low level." The drums were moved to the "bull pen," located in part of the area covered by the 903 Pad (PAC 900-112), on November 15 and 16, 1956. The slab where the drums were stored was cleaned on November 28, 1956.

Although the slab was cleaned where the drums were stored, the area around the contaminated equipment had not been cleaned as of the end of December 1956. The equipment was moved to a production area on site. The loose oxide was removed and the area was covered with plastic to prevent spreading of activity. Smears up to 9,936 dpm were collected prior to vacuuming. Monitoring conducted on December 20, 1956, indicated a maximum of 7,245 dpm on the slab.

No documentation was found that indicated the kinds of materials stored at the site after 1956 or whether the materials were contaminated.

IHSS GROUP 600-3

Fiberglass Area North of Building 664, IHSS 600-120.1

The fiberglassing area, IHSS 120.1, is located north of Building 664. The area is fenced with a small, irregularly shaped fiberglass panel shed (Building 668) in the center of the IHSS.

The fiberglassing area was used from 1972 to 1979 to fiberglass waste packing boxes. The fiberglassing process may have resulted in spills of polyester resin, peroxide catalyst materials, and cleaning solvents, although no documentation of spills was indicated in the HRR research.

No documentation describing discrete releases or detailed response actions in the fiberglassing area was found. Higher-than-background levels of gamma radiation and americium were detected by an Aerial Radiological Measurements System survey. No documentation was found that explained the origin of the elevated readings. Building 664 has been used for radioactive waste storage; however, it is not known whether stored waste was responsible for the elevated historical readings.

During a visual inspection, the area inside the fence was not accessible. However, some dark staining was noted in the north-central part of the IHSS, and the area south of the shed appeared to be poorly paved with asphaltic concrete. At the time of the visual inspection, it was noted that a surface soil location had been sampled in the stained area.

HPGe survey data collected during the OU 12 RFI/RI indicated elevated activities of americium-241, plutonium-239, uranium-235, and uranium-238. Surface soil samples indicated that americium-241, cesium-137, plutonium-239/240, uranium-235, and uranium-238 exceeded background values. These data are available in the IA Data Summary Report (DOE 2000a). Ethylbenzene, methane, toluene, and total xylenes were detected in soil gas samples.

IHSS GROUP 600-4

Radioactive Site Building 444 Parking Lot, IHSS 600-160

IHSS 160 consists of an area that contains the Building 444 parking lot and a section of Seventh Avenue located east of Building 444. This area was previously used as a storage area containing punctured or leaking waste drums and boxes. Wastes resulting from the Buildings 776/777 fire in May 1969 were stored in this area. Aerial photographs taken in June 1965 and June 1969 show drums and boxes in the unpaved area west of Building 444.

Two retired RFP employees interviewed for the HRR stated that the area now occupied by the 444 parking lot had been used for the storage of drummed and boxed waste. In particular, waste resulting from the May 1969 fire in Building 776 and Building 777 was stored there.

On May 24, 1971, two boxes leaked an unknown contaminated liquid onto the ground at the waste box storage yard. Approximately 1,000 ft² of ground were contaminated from 1,000 cpm to greater than 100,000 cpm. The quantity of released liquid was not documented. Apparently the leaks were due to rain or melting snow entering the boxes. The boxes were returned to Building 777. On June 16, 1971, decontamination activities at the waste box storage yard were completed. It is likely that these activities were a result of the May 24, 1971, incident.

An alpha probe survey was conducted during February 1973 on the storage yard east of Building 444, following the removal of some boxes. No contamination was detected. Uranium and plutonium contaminants, as well as oils and coolants, were stored at the storage area in great quantity. An alpha probe survey was made of the ground surfaces in the contaminated waste storage yard east of Building 444 in February 1973. The survey was done after all boxes had been removed. No contamination was detected.

In the early 1970s, surface soil was removed from this area; however, RFP personnel interviewed for the CEARP Phase I mentioned that small amounts of plutonium may have remained.

Soil samples were previously collected around a concrete pad (used to store unused or unusable transformers) located near IHSS 160 at Building 668. Aroclor-1260 was detected in the soil samples with concentrations ranging from 170 to 1,600 µg/kg (EG&G 1991). Plutonium-239/240 activities in these soil samples ranged from 2.3 to 9.1 pCi/g. Plutonium-239/240 was detected at 15.9 pCi/g from 0 to 3 ft in borehole P313489, located in the extreme northeastern corner of the IHSS. Radionuclide measurements at the other previously sampled borehole locations within the IHSS did not indicate high levels of contamination, although results did exceed background for most radionuclides. Inorganic constituents were

not detected. 1,1,1-TCA was detected in each of the 2-ft interval samples collected from 0 to 10 ft. At the southeastern portion of the IHSS (P411589), PCE was detected at a concentration of 5 µg/kg in the 12- to 14-ft interval, and carbon disulfide was detected at a concentration of 9 µg/kg in the 18- to 20-ft interval (DOE 1992a).

Several organic constituents were previously detected in groundwater at downgradient monitoring well 0187, including TCE, PCE, and trans-1,2-dichloroethene.

HPGe surveys conducted during the OU 14 Phase I RFI/RI indicated elevated activities of americium-241 and plutonium-239 in the northwestern part of the IHSS. In the southwestern corner of the IHSS between Buildings 664 and 668, all radionuclides were elevated. NaI surveys indicated the same trends. Ninety-four surface soil samples were collected during the RFI/RI. Analytes found at concentrations above background were chromium, copper, lead, magnesium, mercury, zinc, gross alpha, gross beta, and plutonium-239/240. These data are available in the IA Data Summary Report (DOE 2000a). Organics detected in soil gas samples include acetone, benzene, PCE, and toluene.

IHSS GROUP 600-5

Central Avenue Ditch Cleaning, PAC 600-1004

During a walkdown tour of several IHSSs, Site and Colorado Department of Public Health and Environment (CDPHE) representatives observed EG&G Plant Services personnel spreading excavated soil from the Central Avenue Ditch (IHSS 157.1 for OU 13 and IHSS 172 for OU 8) into areas adjacent to the two large fuel oil tanks located at the southwestern corner of Central Avenue and Seventh Street (IHSS 152).

Potentially contaminated dirt from IHSSs 157.1 and 172 was spread into the IHSS 152 area. The Central Avenue Ditch (IHSS 157.1) was surveyed with an HPGe instrument both before the disturbance and again afterward. No radiological contamination was observed above background levels.

The operation was immediately shut down due to the potential of cross-contamination from one or more IHSSs to IHSS 152.

IHSS GROUP 600-6

Former Pesticide Storage Area, PAC 600-1005

Building 667 was originally used to store pesticides. This site is located several hundred ft north of Building 850 in what is currently parking lot No. 881. In approximately 1982, the shed (Building 667) was moved and located west and south of Building 371. At this new location, the building was renamed Building 367, and pesticide storage in the shed resumed for an unknown time. The shed is no longer used for pesticide storage.

It is believed that pesticides were stored at the Building 667 site at least through 1978. It is possible that pesticides were spilled during loading or mixing operations. In addition, it is possible that the floor in the building was dirt, increasing the possibility of residual amounts of pesticides remaining at the site. No known rinsing of pesticide containers occurred at the shed.

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Pesticides, which are regulated under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), were stored in this area. It is possible that some pesticides were released to the environment. A list of pesticides stored in Building 667 follows:

- Spectracide 600 (ant killer);
- Mouse Maze (poisoned grain for mice and pigeons);
- Bee Bopper (bee and wasp spray, includes chlordane);
- Malkill (insecticide);
- TMTD-Rhoplex (rabbit and deer repellant);
- Decon rodent poison grain;
- Ortho Liquid Iron (grass fertilizer);
- Excel (lawn fertilizer);
- DM14 (herbicide weed control);
- Hyvar X-L (Bromacil weed killer);
- Esteron 76BE (herbicide weed control);
- Tordon 22K (herbicide weed control);
- Ureabor (U.S. Borax granular weed and grass control);
- Banvel;
- Diazon;
- Poison Grain (birds);
- Malathion; and
- Diazinon (black widow spider).

IHSS GROUP 700-1

Identification of Diesel Fuel in Subsurface Soil IHSS 700-1115

On May 31, 1997, while excavating a shallow trench on the northeastern corner of Building 708, workers noted a strong diesel fuel odor and oil staining adjacent to the building at approximately 2 ft bgs. The shallow trench was required to support a new diesel fuel supply line and other associated utilities as part of the Above-Ground Diesel Storage Tank project. The project was halted until environmental and safety professionals could evaluate the discovery and schedule appropriate sampling. During the pre-job safety evolution and utility